ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA

Published by the
ENTOMOLOGICAL SOCIETY OF AMERICA
Formed in 1953 by Consolidation of the
American Association of Economic Entomologists
(1889-1952)
and the former
Entomological Society of America
(1906–1952)

Volume 49 March, 1956 Number 2

ANNALS OF THE ENTOMOLOGICAL SOCIETY OF AMERICA

Published at 50 East Broad St., Columbus 15, Ohio,
for
THE ENTOMOLOGICAL SOCIETY OF AMERICA
1530 P Street, N. W.
Washington 5, D. C.

MAURICE T. JAMES, *Editor*
State College of Washington
Pullman, Washington

EDITORIAL BOARD

H. T. SPIETH, *Chairman*, Riverside, Calif. (C, 1956)
L. E. CHADWICK, Army Chemical Center, Md. (B, 1957)
R. I. SAILER, Washington, D. C. (A, 1958)
M. H. HATCH, Seattle, Wash. (A, 1959)
L. E. ROZEBOOM, Baltimore, Md. (D, 1960)

A bimonthly journal published on the 15th of January, March, May, July, September, November, devoted to the interest of classical entomology. Authors are entirely responsible for statements in the *Annals*, whether of fact or opinion.

TERMS OF SUBSCRIPTION. Non-members in the U.S.A., and Canada—$12.00 per year. Non-members in other countries—$12.00 plus 60¢ postage. Single copies $2.25, plus postage of 10¢ per copy. Deliveries overseas are not guaranteed and foreign mailings are made at the subscriber's risk.

LOST NUMBERS. Missing numbers cannot be supplied free of charge unless notice is received within 60 days after the appearance of issues concerned.

BACK NUMBERS are furnished at the following prices: volumes 1 to 31, $4.00 per volume, $1.00 per issue; volumes 32 to 38, $5.00 per volume, $1.25 per issue; volumes 39 to 45, $6.00 per volume, $1.50 per issue; volumes 46 to 48, $10.00 per volume, $2.50 per issue.

REPRINTS. No gratis copies are supplied. A schedule of prices which will apply to orders received before the Annals is printed, and an order form are sent with proof. For price schedule, see Bulletin of the Entomological Society of America, Vol. 1, No. 4, December, 1955.

BUSINESS COMMUNICATIONS of the Society and **SUBSCRIPTIONS AND MATTERS PERTAINING TO ADVERTISEMENTS** should be sent to the Executive Secretary, Entomological Society of America, 1530 P Street, N. W., Washington 5, D. C. Change of address must reach the office of the Executive Secretary 45 days prior to the month of issue to be effective for that month. Members should make use of the postal regulations which provide for forwarding of second class mail if postage upon delivery is guaranteed.

POSTAL EMPLOYEES send notice on Form 3579 to 1530 P Street, N.W., Washington, D.C.

MANUSCRIPTS and other copy for the Annals should be addressed to the Editor. Prompt publication of acceptable matter may be secured by payment of the cost of printing and engraving ($16.00 per page plus cost of engravings with additional charge for excessive tabular matter). Cost of engravings in excess of $15.00, for each eight printed pages or major fraction thereof, will be charged to the author. Before preparing manuscripts for publication in the Annals, authors are urged to consult the Publication Policies and Manuscript Rules and Suggestions given in Vol. 48 (1–2): 101–3, Jan.-Mar. 1955.

THE THOMAS SAY FOUNDATION. Five volumes have been published. Send inquiries and orders to Executive Secretary, Entomological Society of America, 1530 P Street, Washington 5, D. C.

Entered as second class matter April 11, 1908, at the Post Office at Columbus, Ohio, under the act of Congress of March 3, 1879. Subject to rate of postage provided for in Paragraph 4, Section 538, P. L. & R., authorized September 16, 1940.

Printed by The Spahr & Glenn Company,
Columbus, Ohio, U. S. A.

Issued March 31, 1956.

Annals of
The Entomological Society of America

Volume 49 MARCH, 1956 No. 2

VARIATIONS IN THE ACTIVITY OF THE SUCCINOXIDASE SYSTEM DURING THE DEVELOPMENT OF THE MEALWORM, TENEBRIO MOLITOR LINNAEUS (COLEOPTERA, TENEBRIONIDAE)[1]

DANIEL LUDWIG AND MARY C. BARSA
Department of Biology, Fordham University

Ludwig, Barsa, and Cali (1955) studied the activity of cytochrome oxidase in larvae of the mealworm, *Tenebrio molitor*, and found enormous variations. Since Sacktor (1950) reported that the adult house fly, *Musca domestica*, showed an increase of 118 percent in the activity of cytochrome oxidase within the first day after emergence, we decided to study changes in the activity of this enzyme during the larval growth and metamorphosis of the mealworm when reared at a constant temperature of 30° C. These experiments were extended to include studies on the activity of succinic dehydrogenase, another important constituent of the succinoxidase system.

MATERIALS AND METHODS

Eggs of the mealworm were obtained from beetles kept in white flour. They were collected daily and put in desiccators, the bases of which contained a saturated solution of NaCl (relative humidity, 75 percent) and were incubated at 30° C. Groups of larvae, within 24 hours of eclosion, were placed in dated beakers containing chick growing-mash and kept at 30° C. Water was added daily.

The activities of cytochrome oxidase and succinic dehydrogenase were determined on larvae for each week of the larval stage, on prepupae, on pupae for each day of the pupal stage, and on newly emerged adults. In each case enzyme activity was measured on tissue homogenates in a final concentration of 1:10,000. The insects were homogenized in 0.03 molar phosphate buffer adjusted to a pH of 7.4. Cytochrome oxidase activity was measured by the method of Cooperstein and Lazarow (1951), and succinic dehydrogenase by that of Cooperstein and Lazarow (1950). The latter procedure is now known to measure the activity of a group of enzymes of which succinic dehydrogenase is a component.

OBSERVATIONS

The activity of cytochrome oxidase was found to increase rapidly during the first 2 weeks of larval life. Figure 1 shows that the activity values, expressed as $\triangle \log [Cy\ Fe^{++}]$ per minute, increased from 0.03 in newly hatched larvae to a high value of 0.14 at the end of 2 weeks. They then decreased rapidly, reaching 0.014 at the end of 8 weeks. They remained relatively unchanged throughout the remainder of the larval period, fluctuating between 0.01 and 0.03. During the pupal stage, they increased rapidly beginning with the third day following pupation and reaching a value of 0.046 just before emergence, and of 0.073 in newly emerged adults.

The activity of succinic dehydrogenase followed a similar series of changes during growth and metamorphosis. Activity values (shown in Figure 1), and expressed as $\triangle \log [Cy\ Fe^{+++}]$ per minute, averaged 0.004 in newly hatched larvae. They increased to 0.022 at the end of 2 weeks. Thus in the case of each enzyme, there was an approximately 5-fold increase in activity during the first 2 weeks of larval life. The activity of succinic dehydrogenase remained at a relatively high value during the first 10 weeks, then decreased to a low value of approximately 0.008 where it remained until the latter part of the pupal stage. It then increased reaching 0.023

[1]This investigation was supported in part by the Medical Research and Development Board, Office of the Surgeon General, Department of the Army, under Contract No. DA-49-007-MD-444.
Accepted for publication, May 3, 1955.

in the late pupa, and 0.029 in the newly emerged adult.

DISCUSSION

The increase in the activity of cytochrome oxidase reported here for the early larval period is much greater than that found by Sacktor (1950) for the newly emerged adults of the house fly. In the present experiments, the increased rate persisted for at least 6 weeks of larval life at 30° C. These results offer a possible explanation for the variability of cytochrome oxidase activity of mealworm larvae from mixed cultures reported by Ludwig, Barsa, and Cali (1955). In the present experiments, the activity curves for cytochrome oxidase and succinic dehydrogenase during the period of metamorphosis are not U-shaped, although respiratory metabolism during the pupal stage of this insect was found by Krogh (1914) to follow a U-shaped curve. The results indicate that these enzymes may not be rate limiting factors in the respiratory exchange during the pupal stage of this species. They are in contrast to the observations of Sacktor (1951) for the house fly, and of Ludwig (1953) for the Japanese beetle, where the activities of cytochrome oxidase were found to be U-shaped during the pupal stage and to parallel the rates of oxygen consumption.

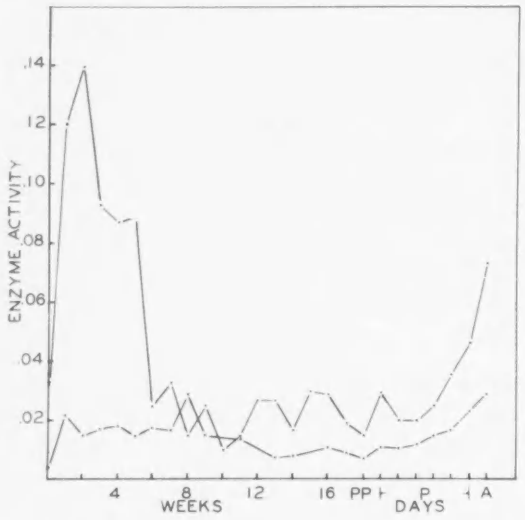


FIGURE 1. Enzyme activities during larval, prepupal, and pupal stages. Upper curve, cytochrome oxidase; lower curve, succinic dehydrogenase. Activity of cytochrome oxidase expressed as $\triangle$ log [Cy Fe^{++}] /min.; of succinic dehydrogenase as $\triangle$ [Cy Fe^{+++}] /min. Enzyme activities measured on homogenates in final concentrations of 1: 10,000. Larval age expressed in weeks; pupal age in days. PP, prepupa; P, pupa; A, adult. Each point is an average of at least 10 determinations.

SUMMARY

There was a 5-fold increase in the activities of both cytochrome oxidase and succinic dehydrogenase during the first 2 weeks of the larval period of the mealworm, *Tenebrio molitor*. This higher rate of enzyme activity was maintained for approximately 6 weeks of larval life. Enzyme activity then decreased to a low level and remained relatively constant until the latter part of the pupal period, when it again increased.

REFERENCES CITED

Cooperstein, S. J., and **A. Lazarow.** 1950. A microphotometric method for the determination of succinic dehydrogenase. Jour. Biol. Chem., 186: 129–39.

1951. A microphotometric method for the determination of cytochrome oxidase. Jour. Biol. Chem., 189: 665–70.

Krogh, A. 1914. On the rate of development and CO_2 production of chrysalides of *Tenebrio molitor* at different temperatures. Zeitschr. allg. Physiol., 16: 178–90.

Ludwig, D. 1953. Cytochrome oxidase activity during diapause and metamorphosis of the Japanese beetle (*Popillia japonica* Newman). Jour. Gen. Physiol., 36: 751–757.

Ludwig, D., M. C. Barsa, and **C. T. Cali.** 1955. The effect of DDT on the activity of cytochrome oxidase. Ann. Ent. Soc. Amer. 48: 165–70.

Sacktor, B. 1950. A comparison of the cytochrome oxidase activity of two strains of adult house flies. Jour. Econ. Ent., 43: 832–838.

1951. Some aspects of respiratory metabolism during metamorphosis of normal and DDT-resistant house flies, *Musca domestica*. Biol. Bull., 100: 229–43.

A POPULATION OF URANOTAENIA ANHYDOR FROM DEATH VALLEY, WITH DESCRIPTIONS OF ALL STAGES AND DISCUSSION OF THE COMPLEX (DIPTERA, CULICIDAE)[1]

JOHN N. BELKIN AND WILLIAM A. McDONALD
University of California, Los Angeles

INTRODUCTION

Uranotaenia anhydor Dyar, 1907 is regarded as one of the rarer North American mosquitoes. The original description was based on a single larva collected by Dyar and Caudell on June 2, 1906 in a swamp full of reeds at Sweetwater Junction (now part of National City), near San Diego, Calif. Subsequently, Dyar reared a series of adults of both sexes from larvae collected in Old Town, San Diego (Howard, Dyar and Knab, 1917, 4: 1041–1042), Freeborn (1926: 350) reported a single female from Camp Kearney (near San Diego), and E. A. Seaman and C. S. Richards found two larvae near Bonsall, San Diego County (Seaman, 1945). Brookman and Reeves (1953: 234–235) were the first to report this species outside of San Diego County, having reared an adult of each sex from two pupae collected in northwestern Baja California, Mexico, some 45 miles south of San Diego. These authors also mentioned a series of rubbed females apparently of this species collected at lights by C. B. and R. N. Philip at Fairbanks Springs, Ash Meadows, Nye County, Nevada, on August 21, 1949. In the summer and fall of 1953, C. S. Richards took a small series of *anhydor* females in light traps and one larva and one pupa at St. David, Cochise County, Arizona (Richards, 1954 *in lit.*).

Closely related to *U. anhydor* is the more widely distributed and apparently more common *U. syntheta* Dyar & Shannon, 1924, originally described from a single female reared from a larva collected at Mission, Hidalgo County, Texas, in the lower Rio Grande Valley. Dampf (1943) reported *syntheta* adults quite common in the States of Jalisco and San Luis Potosi as well as in the Federal District of Mexico. Subsequently, this form has been found widely distributed in Texas (McGregor and Eads, 1943; Randolph and O'Neill, 1944; Rueger and Druce, 1950; Eads, Menzies and Ogden, 1951), western Oklahoma (Griffith, 1952) and eastern New Mexico (Ferguson and McNeel, 1954), but is apparently very localized and difficult to find in the immature stages.

Recently it has been pointed out that *anhydor* and *syntheta* are so close morphologically that when material from intermediate areas, such as the population from Fairbanks Springs, is examined the two forms may prove to be subspecies or even extremes of a single variable species (Brookman and Reeves 1953: 235; Galindo, Blanton and Peyton 1954: 118–119).

Since August, 1952 we have periodically visited Saratoga Springs, San Bernardino County, California, in the southern end of Death Valley near the sharp bend in the lower part of the Amargosa River drainage system. As what appeared to be *U. anhydor* had been collected at Fairbanks Springs, some 60 miles to the north in the same drainage system, we suspected that this species might be breeding at Saratoga Springs. On our fourth visit, on June 16–19, 1954, we finally succeeded in collecting adults of *U. anhydor* and in locating its immature stages. Additional visits on July 27–28, Sept. 11–12, and Oct. 16–17, 1954 resulted in the collection of abundant material of all stages and some ecological information.

We have studied all the stages of the Saratoga Springs population in considerable detail and have compared it with the limited available material of *anhydor* from San Diego County, Baja California and Arizona, and *syntheta* from several localities in Texas. It is rather surprising to find that the Saratoga Springs population is distinct from both *anhydor* and *syntheta* and that it is in no way intermediate between the two. However, this population exhibits in the immature stages such plasticity and strong morphological response to variations in environmental conditions that we feel that comparable material from several localities must be studied before any decision is made as to the taxonomic status of the various populations of the complex west of the Continental Divide. As none of the members of the complex have been described in detail, we are presenting at this time such descriptions of the Saratoga Springs population with emphasis on the immature stages. We are also including ecological notes and comparative data on other populations.

The descriptive terminology used is that of Belkin (1953a) except for corrections in the nomenclature of the larval and pupal chaetotaxy (Belkin 1953b). It is quite evident from inspection of the chaetotaxy of successive larval instars that additional corrections are needed, particularly in the thoracic chaetotaxy. We believe that such corrections should be postponed until early instars of all mosquito genera are studied.

[1]Accepted for publication, Dec. 2, 1954.

The data on the branching of hairs are indicated in parentheses following the hair number in this order: usual number of branches (representing 75% or more); mean; range. The measurements are all approximate and are based on no more than five specimens.

The figures of the first three larval instars are based on the study of a few specimens and are not intended to represent the modal chaetotaxy. On the other hand, the figures of the fourth larval instar and the pupa represent the modal chaetotaxy based on the study of all the specimens indicated in the tables. All the larval figures were drawn from somewhat flattened specimens mounted in a modified Berlese medium and therefore show considerable distortion. The figures of the female head and thorax are generalized and are intended to show only the differences in the pattern of bluish scales.

The following material was examined for this study: CALIFORNIA.—*Saratoga Springs*, San Bernardino Co., June 16–19 (UCLA 110, 114), July 27–28 (UCLA 127, 128), Sept. 10–11 UCLA 143, 144), Oct. 16–17, 1954 (UCLA 146, 147), 1046 adults (575♂, 471♀), 425 pupae, over 2000 fourth instar larvae, over 1000 each of third, second and first instar larvae, 18 egg rafts, 99 individual rearings (50♂, 49♀; 73 larval, 26 pupal) (Belkin and McDonald) [UCLA, USNM, CAS, CDC, CU, UCB, UCD, etc.]; *San Diego*, May 6-20, 1916, 5♂, 3♀, 3 pupae, 3 fourth instar larvae, 4 third instar larvae (H. G. Dyar) [USNM, UCLA]; *Bonsall*, San Diego Co., Sept. 15, 1944, 1 fourth instar larva (E. A. Seaman and C. S. Richards) [USNM]. MEXICO.—*Baja California*, highway 1, 46 km. south of Tijuana, June 13, 1948, 1♂, 1♀, 1 pupa (B. Brookman and W. C. Reeves) [CAS]. NEVADA.—*Fairbanks Springs*, Ash Meadows, Nye Co., Aug. 21, 1949, 6♀ (C. B. and R. N. Philip) [Philip, UCLA]. ARIZONA.—*St. David*, Cochise Co., July 20, Oct. 12, 23, 1953, 2♀, 1 fourth instar larva (C. S. Richards) [Richards, UCLA]. TEXAS.—*Dallas*, July 30, 1940, 1♂ (E. W. Laake and W. G. Bruce) [USNM]; *Fort Worth*, Meacham Field, July 10–11, 1944, 1♂ (J. E. Porter) [USNM]; *Kerrville*, June 19, July 3, 1953, 1♂, 1♀ (L. J. Boltimer) [USNM]; *San Marcos*, Hays Co., Aug. 8, 1943, 1♀ [USNM]; *Hays Co.*, July 1943, 1♀ [CDC]; *Luling*, Palmetto State Park, May 22, 24 and June 17, 1947, April 6 and Oct. 12, 1953, Oct. 16, 1954, 12♂, 3♀, 27 fourth instar larvae, 19 whole pupae (O. P. Breland) [CAS, CDC, UCLA]; *San Antonio*, Camp Normovle and Ft. Sam Houston, July 6–Oct. 20, 1942, 4♂, 30♀, 1 pupa, 30 fourth instar larvae, 2 third instar larvae, 1 second instar larva, 2 first instar larvae (E. S. Ross) [CAS, CDC, UCLA, USNM]; *Bexar Co.*, June 7 and Oct 23, 1943, 3♀ [CDC]; *Del Rio*, Val Verde Co., May 23, 1928, 1♀ (W. H. W. Komp) [USNM]; *Cameron Co.*, 1♀, no date [USNM].

We are greatly indebted to the following individuals and institutions for the loan of material: Dr. Alan Stone and the United States National Museum [USNM]; Dr. E. S. Ross, California Academy of Sciences [CAS]; Dr. O. P. Breland, University of Texas; Dr. C. B. Philip, Rocky Mountain Laboratory; Dr. W. C. Reeves, Univ. of California, Berkeley [UCB]; Dr. B. Brookman and C. S. Richards, Water Projects Unit, U.S. P.H.S.; Dr. H. D. Pratt, Communicable Disease Center, U.S.P.H.S. [CDC].

DESCRIPTIONS

1. *Female*

Saratoga Springs population (Fig. 1a)

Wing: 2.5 mm. Abdomen: 1.65 mm. Proboscis, 1.60 mm. Front femur: 1.50 mm. In general as in description of ***anhydor*** (Howard, Dyar & Knab 1917, 4: 1041–1042), with the additions and exceptions noted. Specimens examined: 471.

Head: Frontal tuft not developed; orbital light line expanding laterally and bent toward ***apn***, scales light bluish; numerous elongate dark erect vertical scales, stem slender, apex expanded but not distinctly forked; orbital bristles 1: 1: 1: 3 (4). Clypeus dark brown. Palpus about 0.08 of proboscis; dark brown scales apically; some of the slender hairs about equal to shaft length; segmentation not apparent. Proboscis strongly swollen apically; dark-scaled dorsally, lighter ventrally, especially on swollen part; numerous short hairs basally, longer and darker dorsoapically; labella dark, densely hairy. Antenna about 1.45 of proboscis; torus yellowish brown, with short hairs and a few short dark scales mesally; base of first flagellar segment yellowish brown, remainder of flagellum very dark brown, almost black; first flagellar segment mesally with about 8 dark scales somewhat longer than those on torus; apical flagellar segments subequal; usually 6 dark bristles in a flagellar whorl.

Thorax: Scutal integument brown to dark brown, often darker near anterior light-scaled area; rather sparse vestiture of recumbent narrow elongate curved dark bronzy scales, distinctly longer and lighter in color caudad, particularly in prescutellar space; an elongate patch of several rows of broad, apically rounded appressed iridescent light blue scales (becoming white or violet in some aspects) laterally on each side from some distance in front of scutal angle to level of humeral bristles; often a few almost black narrow scales laterad of this patch; area mesad of patch often with darker integument and usually with sparse vestiture of narrow dark scales; another patch of light scales on each side just above paratergite from in front of wing root to about level of spiracle, scales of same coloration as those in anterior patch, short and broad cephalad, progressively longer caudad, forming a

conspicuous outstanding tuft in front of wing root; area cephalad and immediately dorsad of supraalar patch usually without or with only a few narrow bronzy scales; the two light-scaled patches not in line; 10 or more pairs of short acrostichals; dorsocentrals and prescutellars well developed; 2 or 3 pairs of humerals; other bristles well developed, all dark. Scutellum brown; median lobe well developed, usually with 5 strong marginal bristles; lateral lobe with 4 strong marginal bristles; additional smaller bristles often present on all lobes; vestiture of recumbent narrow elongate curved light bronzy scales. Pleural integument brown, darker on *apn* and central portions of *stp* and *me;* scaling and chaetotaxy as figured; *ppn* with a few narrow recumbent dark bronzy almost black scales near upper margin, usually one sometimes 2 dark bristles; *apn* with patch of appressed rounded bluish scales, bristles 2: 1; one dark *pa* bristle; upper part of *stp* with a broad patch of similar scales, narrower and longer caudad, usually 5 dark bristles; lower posterior part of *stp* with a smaller patch of similar scales, usually one dark bristle and several light hairs; usually 1–3 strong dark *pp* and several light hairs; one strong dark *lme;* about 8 light *ume.* Halter light brown at base and stem, dark-scaled on knob.

Wing: Distance between crossveins 0.9–1.2 length of *m-cu.* Vein R_2 about 0.79 of R_{2+3}; vein M_{1+2} about 0.70 of M beyond *m-cu.* Anterior margin of R to slightly beyond arculus with dingy white or yellowish scales; remaining dorsal scales dark; fringe dark apically, lighter proximally. Microtrichia unusually conspicuous.

Legs: Coxae and trochanters light brown; fore coxa with a few broad bluish or whitish scales at base on anterior face followed by more numerous broad dark scales, mid and hind coxae with a few translucent broad scales; femora dark-scaled above, dingy white below to apex; knee spots on all femora, consisting of a few dingy white scales to rarely numerous pure white scales, more conspicuous on hind femur; tibia dark above, lighter below; hind tibia usually with a few dingy or pure white scales near apex; other tibiae rarely with such light spot; tarsi dark. Leg I: femur 1; tibia 1.03; tarsus 0.68, 0.29, 0.19, 0.11, 0.13. Leg II: femur 1.08, swollen basally; tibia 1.26; tarsus 0.80, 0.28, 0.14, 0.12. Leg III: femur 1.00; tibia 1.19; tarsus 1.11, 0.48, 0.32, 0.20, 0.12. All claws small, simple, subequal.

Abdomen: Tergite 1 with dark scales only; tergites 2–7 dark-scaled except for yellowish-brown to dingy white lateral basal patches; sternites with yellowish brown or dingy white scales.

Variation: The most conspicuous variation is in the amount and intensity of the light scaling on the head, thorax, abdomen and legs. All of the 471 females examined showed a well-defined prescutal light patch consisting of several rows of bluish scales. Frequently the length of this patch approaches that of the single line found in Texas *syntheta* but it may be reduced to the condition encountered in the most conspicuously marked individual of *anhydor* from Arizona. The supraalar patch of light scales usually consists of broad scales anteriorly but rarely a few of these are elongate. This patch may also rarely extend almost to the scutal angle, again approaching the condition found in Texas *syntheta.* The abdominal lateral light spots are well marked and almost pure white in a few individuals, as are the knee spots. Considerable variability is shown also in the density as well as coloration of the narrow dark scutal scales. Usually these are darker and much less numerous than in other *anhydor* populations. Reared individuals generally have a much lighter integu-

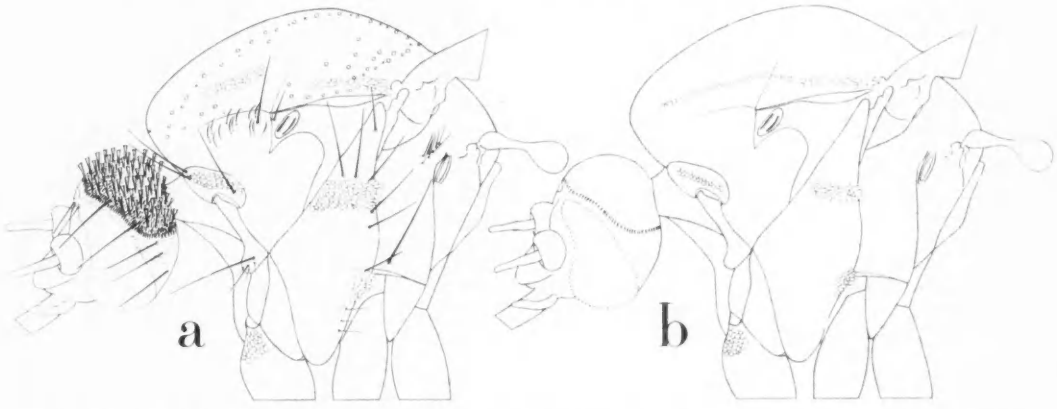


FIG. 1. Left lateral aspect of head and thorax of adult female of *Uranotaenia anhydor.* a, *U. a. anhydor* Dyar, Saratoga Springs population; b, *U. a. syntheta* Dyar & Shannon, Fort Sam Houston, Tex., showing differences in pattern of bluish scales only.

ment than field-collected specimens. One individually reared specimen (143–111) shows a remarkable departure from the rest in the development of broad appressed whitish scales symmetrically arranged in the space between the acrostichal and dorsocentral rows of bristles from the prescutellar space to almost the level of the scutal angle.

Fairbanks Springs population

The six females from Fairbanks Springs are badly rubbed and therefore lack most of the diagnostic features. However, all the visible characters indicate that this population will probably prove to belong to the same taxon as the Saratoga Springs population.

San Diego population

The description of the adults of typical *anhydor* is based on this population (Howard, Dyar & Knab, 1917, 4: 1041–1042). The three specimens we have seen agree well with this description as far as it goes. In general they also fit the more detailed description of the Saratoga Springs population except for the following: Somewhat larger in size, wing length 2.6–2.8 mm. Generally lighter in coloration; this is probably partially due to the age of the specimens as well as to the fact that they were reared. Scutum not darkened in area of light-scaled patch; dark scales lighter in coloration, longer and more numerous. Prescutal light-scaled patch poorly developed, inconspicuous, streaklike, consisting of about two rows of bluish scales surrounded by elongate light coppery scales; in one specimen reduced to two or three light scales. Supra-alar light-scaled patch well developed, anterior scales longer; area around patch with numerous elongate light coppery scales. Knee spots small, dingy white; undersurface of legs lighter in coloration. Abdominal tergal light spots dingy white. The upright vertical scales of the head are usually distinctly forked.

Baja California population

The single known specimen resembles the San Diego material. It has a wing length of 3.1 mm. The prescutal light-scaled patch is represented by a single small bluish scale on each side; the integument in this area is somewhat darkened and is densely covered with narrow elongate bronzy and coppery scales. The supra-alar patch is also reduced; there are only a few elongate bluish scales among many slender outstanding as well as recumbent coppery scales. The pleural light-scaled patches have smaller and more elongate scales. The tergal abdominal spots and the knee spots are reduced.

Arizona population

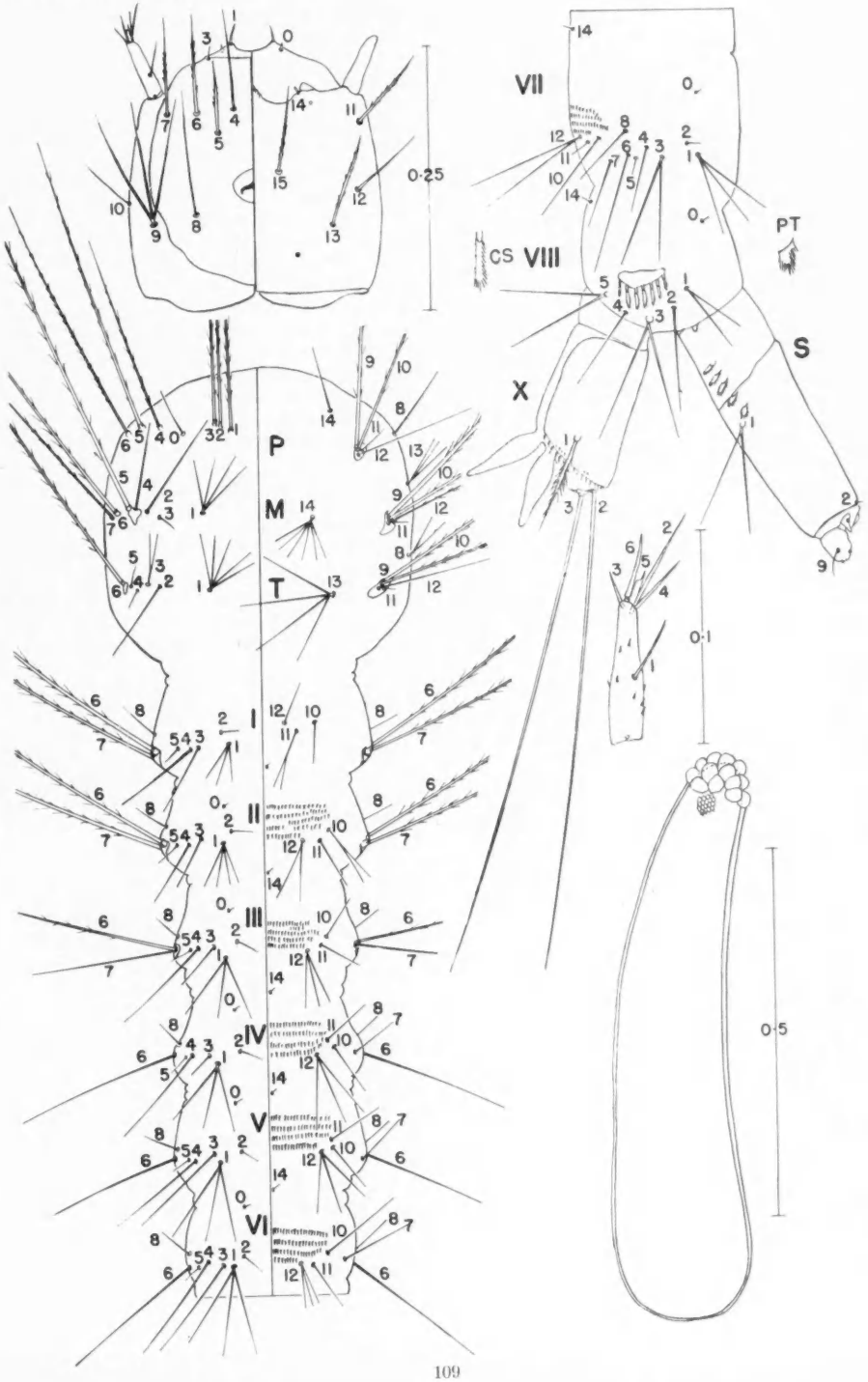
Two specimens collected in light traps on July 20 and Oct. 12, 1953 were examined. The wing lengths are 2.9 and 3.1 mm. respectively. The July specimen has a short well-marked prescutal patch of several rows of light blue scales. It also resembles Saratoga Springs specimens in its well-developed supraalar patch but differs in having numerous elongate coppery scales in this area. However, in overall features it is closer to an extremely well-marked San Diego specimen. The October specimen has the prescutal patch reduced to two light scales on the right side and a streak of about 8 short inconspicuous light scales in a single row on the left side; on both sides the light scales are surrounded by a dense vestiture of bronzy scales. The supraalar patches contain only a few elongate bluish scales posteriorly and more numerous bronzy and coppery elongate scales anteriorly. Superficially the coloration of this individual is very close to that of the Baja California specimen.

Texas populations (Fig. 1b)

Forty-one females from six different counties in Texas were examined. Despite some variation, all of them can be distinguished from the *anhydor* populations to the west on the basis of the extent of the light scaling of the mesoscutum as originally indicated by Dyar and Shannon (1924: 187,189). The following additions and corrections to their description and comparisons with the Saratoga Springs population appear desirable: Wing length 2.2–2.9 mm. Scutal integument and dark vestiture as in Saratoga Springs populations; bristles darker; prescutal blue scales in a single row forming a long streak usually from transverse suture of scutal angle to anterior dorsocentral bristles; space mesad of streak, particularly near middle, with few or no bronzy scales, space laterad of streak with very dark bronzy narrow scales; supraalar blue scales in a streak in line with prescutal streak, extending to the transverse suture and often forming a continuous line, scales broad anteriorly, elongated near wing root, surrounding area with few or no bronzy scales; light-scaled patch on *apn* and upper *stp* narrower. Wing with whitish scales at base of anterior margin of R to slightly beyond arculus, a few whitish scales on posterior margin near apex of this light streak. Fore coxa with a patch of bluish scales; knee spots large, conspicuous, pure white; similar white spots at apices of tibiae, smaller on mid leg; femora and fore and mid tibiae light-scaled below; tarsal segments lighter below. Abdominal tergal spots pure white; sternites cream-colored.

EXPLANATION OF PLATE I

FIG. 2. Egg and first instar larva of *Uranotaenia a. anhydor* Dyar, Saratoga Springs population. Lateral aspect of egg, showing detail of exochorion near upper end only; dorsal (left) and ventral (right) aspect of head, thorax and proximal abdominal segments, left lateral aspect of terminal abdominal segments, and dorsal aspect of left antenna of first instar larva.


0·25
P
M
T
I
II
III
IV
V
VI
VII
VIII
CS
PT
S
X
0·1
0·5

2. *Male*

Saratoga Springs population

Wing: 2.0–2.5 mm. Abdomen: 1.9–2.0 mm. Proboscis: 1.45–1.7 mm. Front femur 1.4–1.6 mm. Generally very similar to female. Proboscis moderately swollen. Flagellar whorls about 0.45 of flagellum, about 30 bristles in whorl; penultimate segment about 4.0 of preceding, apical about 0.90 of penultimate. Leg I: femur 1; tibia 1.06; tarsus 0.57, 0.29, 0.18, 0.09, 0.10; claws enlarged, unequal, larger strongly curved. Leg II: femur 1.10; tibia 1.24; tarsus 0.71, 0.31, 0.19, 0.09, 0.10; claws enlarged, very unequal, larger very strongly curved. Leg III: femur 1.00; tibia 1.20; tarsus 1.00, 0.51, 0.39, 0.23, 0.14; claws small, equal. Light scaling of thorax about as extensive as in female; abdominal light spots not distinct. *Male genitalia* apparently indistinguishable from those of other populations, very similar to published figures for *anhydor* (Brookman and Reeves 1953:227; Galindo, Blanton and Peyton 1954:123) and *syntheta* (Dampf 1943:162–165, plate 8); shape of ninth tergite lobes variable; proctiger with a distinct large lateral spiculate sclerotization on each side (also present but not described in other populations). Specimens examined: 575, 10 genitalia mounts.

San Diego population

All five specimens from San Diego are in general similar to the females except that all of them have the prescutal light-scaled patch much better developed. This patch consists of several rows of blueish scales much as in the less well-marked members of both sexes of the Saratoga Springs population. The supraalar patch of bluish scales is also better developed than in the females. No obvious differences were noted in the single genitalia mount.

Baja California population

The single known male is extremely similar to the female except that it has a distinct prescutal light-scaled streak, consisting of about two rows of bluish scales. This patch is smaller and less distinct than in any of the San Diego specimens. No obvious differences were noted in the mounted genitalia.

Texas populations

The 19 males from five different localities appear to be identical with the females in coloration except that the abdominal light spots are greatly reduced or even apparently completely absent. No obvious differences from the Saratoga Springs population were noted in 8 genitalia mounts.

3. *Egg*

The egg stage is known only for the Saratoga Springs population. The eggs are laid in boat-shaped rafts as in the case of most other species of *Uranotaenia*. The rafts are tapered to a point at one end and broadened and rounded at the other end as seen from above and generally are about three times as long as the median width, measuring about 2–2.5 mm. in length and about 0.6–0.8 mm. in median width at the top and up to 3 mm. by 1 mm. at the bottom. Several shorter broader rafts were also collected. The rafts are rather strongly concave at the bottom in side view. The lower surface of the raft, as seen in alcohol-preserved material, is covered with a continuous amorphous translucent pellicle which forms an opaque white disc at the lower end of each egg. The number of eggs in a raft varies considerably but is generally between 80 and 100. The mature individual egg (fig. 2) is uniformly dark brown, almost black. It is about 0.75–0.80 mm. in length and approximately 0.15–0.16 mm. in median width. One surface is slightly concave while the opposite surface is more strongly convex near the upper end but shows a flattening near the lower third. The lower end is enlarged and broadly rounded except for a somewhat flattened extreme apex. The egg is gradually tapered to the upper end which is more acutely rounded. The exochorion appears to be thicker on the concave side. Its ornamentation consists of extremely minute hexagonal reticulations over the entire surface except for the extreme upper end. The latter bears a group of two dozen or more roughly hemispherical translucent projections which appear to arise from hexagonal bases. This type of ornamentation is apparently not found in mosquitoes of other genera. Specimens examined: 18 rafts, 50 individual eggs.

4. *First Instar Larva*

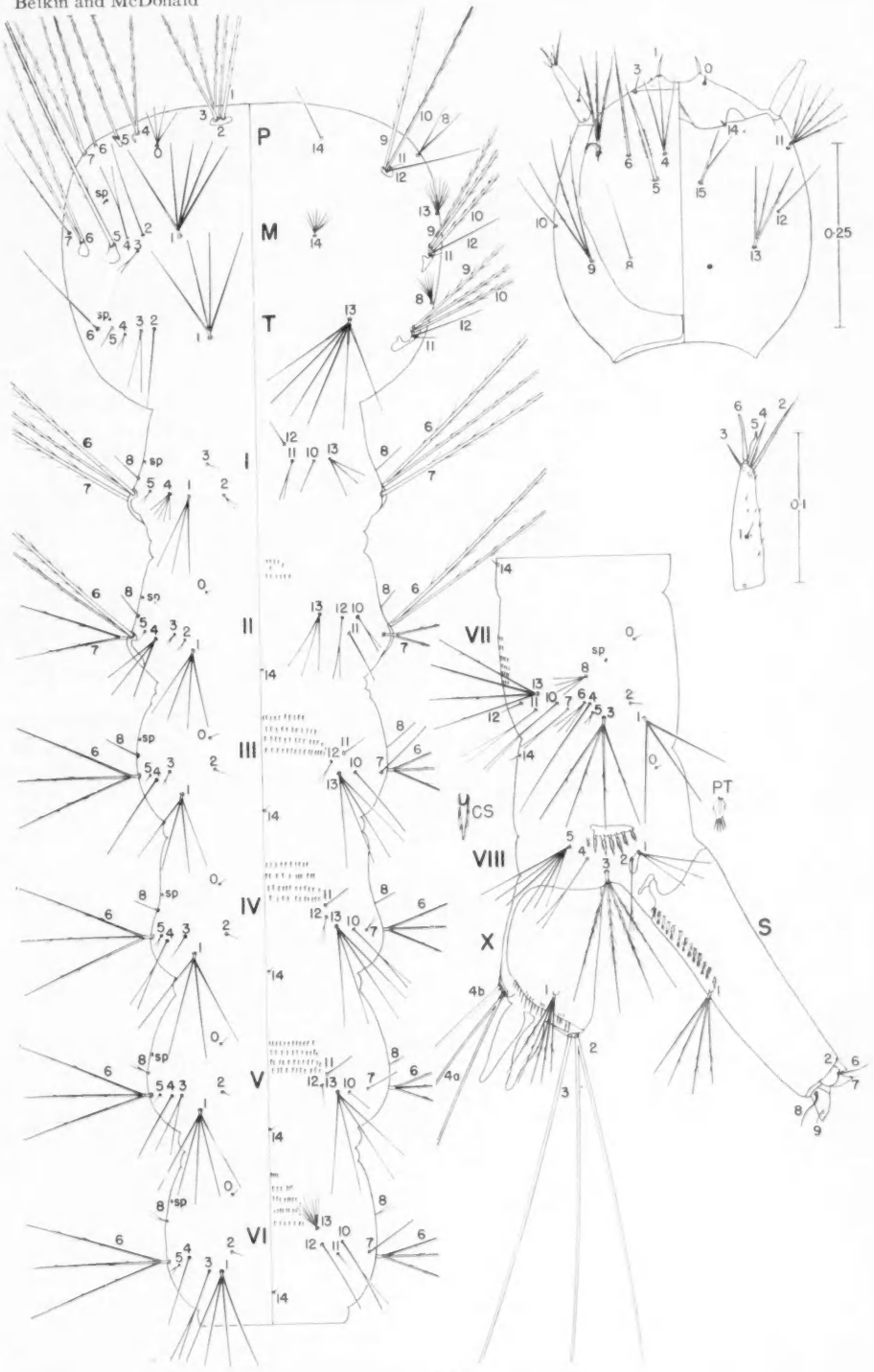
Saratoga Springs population (Fig. 2)

Head: 0.25 mm. Siphon: 0.23 mm. (sclerotized part about 0.17 mm.). Anal saddle: 0.14 mm. Specimens studied: 22.

Head: Width about 0.9 of length, greatest beyond middle; no distinct ocular bulge; pigmentation uniformly dark brown except for lighter ocular areas, a narrow black caudal ring incomplete dorsally, and black heavily sclerotized egg tooth; integumentary imbricate sculpturing well developed, uniform. No distinct collar; "ocular plate" with moderate dorsal caudal projection occupying area without black caudal ring; this projection probably represents the collar. Labrum well developed, about one-third width at 1-C; median emargination often deeper than

EXPLANATION OF PLATE II

FIG. 3. Second instar larva of *Uranotaenia a. anhydor* Dyar, Saratoga Springs population. Dorsal (left) and ventral (right) aspect of head, thorax and proximal abdominal segments, left lateral aspect of terminal abdominal segments, and dorsal aspect of left antenna.


P
M
T
I
II
III
IV
V
VI
VII
VIII
X
S
CS
PT
sp
0·25
0·1

shown on figure. Mental plate small, prominent, heavily sclerotized and black anteriorly; one strong median tooth and about 3-5 indistinct teeth on each side. Hairs of head capsule darker than integument, usually all single except 9-C which is usually 3b; 8, 10, 12–C occasionally 2f; heavier hairs barbed or minutely fringed. Antenna about 0.24 of head, distinctly narrowed at about middle; lighter in pigmentation than head capsule; spicules small, dark, sparse; a minute clear circular area at base dorsally, probably representing a sense organ. Antennal hairs lightly pigmented, apex of 5-A transparent; relative position, length and degree of development as figured; all single; 1-A at about middle of antenna, slightly more than 0.5 of shaft length.

Thorax: Integument smooth, nude, unpigmented. Larger hairs strongly pigmented, fringed or barbed; smaller hairs moderately or lightly pigmented; large hairs usually all single, with poorly pigmented basal tubercles, alveolar rim produced necklike around shafts; hairs 9–12 on common tubercles, 4, 5–M on common tubercles, all others usually separate, 6, 7-M sometimes with common tubercle; relative position, length, and degree of development of hairs as figured; hairs 1, 13, 14-M, 1, 3, 8, 13-T branched, double to multiple; 0-P often branched or forked; all other hairs usually single; 7-P, 8-M, 7-T absent, probably these hairs are homologous. Meso- and metathoracic spiracle rudiments not developed.

Abdomen: Integument smooth and nude throughout except for about 4 or 5 ventral median rows of spicules on II-VII; hairs 6, 7–I, II, 6–III with sclerotized basal tubercle plate; larger hairs with long necklike extension of alveolus around shaft; relative position, length and degree of development of hairs as figured; all hairs generally single and simple except as noted; 1-I-VIII usually 3b; 3-VII usually 2b; 6-I-III, 7-I, II single, fringed or barbed; 11-I, 10-II often 2f; 12-II-VII usually 2, 3b; 3, 5-VIII usually 2b; 1-S usually 2b; 1-X heavy, strongly barbed; 2, 3-X long, smooth; hairs 9, 13-I-VII, 8-S, 4-X absent, all others present as in fourth instar. Segment VIII: comb plate small, indistinct, restricted to base of scales; one or more scales free; scales usually 7 or 8, elongate, not tapered or pointed apically, with distinct fringe apically and laterally, at least on one side. Siphon: as figured, index about 3.5; basal 0.25 or more not sclerotized; distal, sclerotized part dark brown, with distinct imbrications; pecten restricted to basal half; teeth usually 5 or 6, three or more of which are on unsclerotized part; individual tooth broad, fringed laterally and apically; acus of two separate small unconnected plates on each side; hair 1 usually 2b, inserted slightly proximad of 0.5 of siphon; hair 2 single, minute; hair 13 minute or undeveloped, never twisted at base. Anal segment: saddle incomplete, brown, slightly darker dorsad; median width about 0.55 length; imbrications distinct; apical margin with short spines merging proximad into spicules arising from imbrications; gills subequal, about 0.55 saddle length, distinctly narrowed toward apex which is rounded; hairs 2 and 3 subequal, about 3.5 of saddle length. Spiracular rudiments on I-VII not developed. Dorsal sensilla on III-V not developed.

Other populations

Two specimens from San Antonio, Texas are indistinguishable from the Saratoga Springs population. No other material was available for study.

5. *Second Instar Larva*

Saratoga Springs population (Fig. 3)

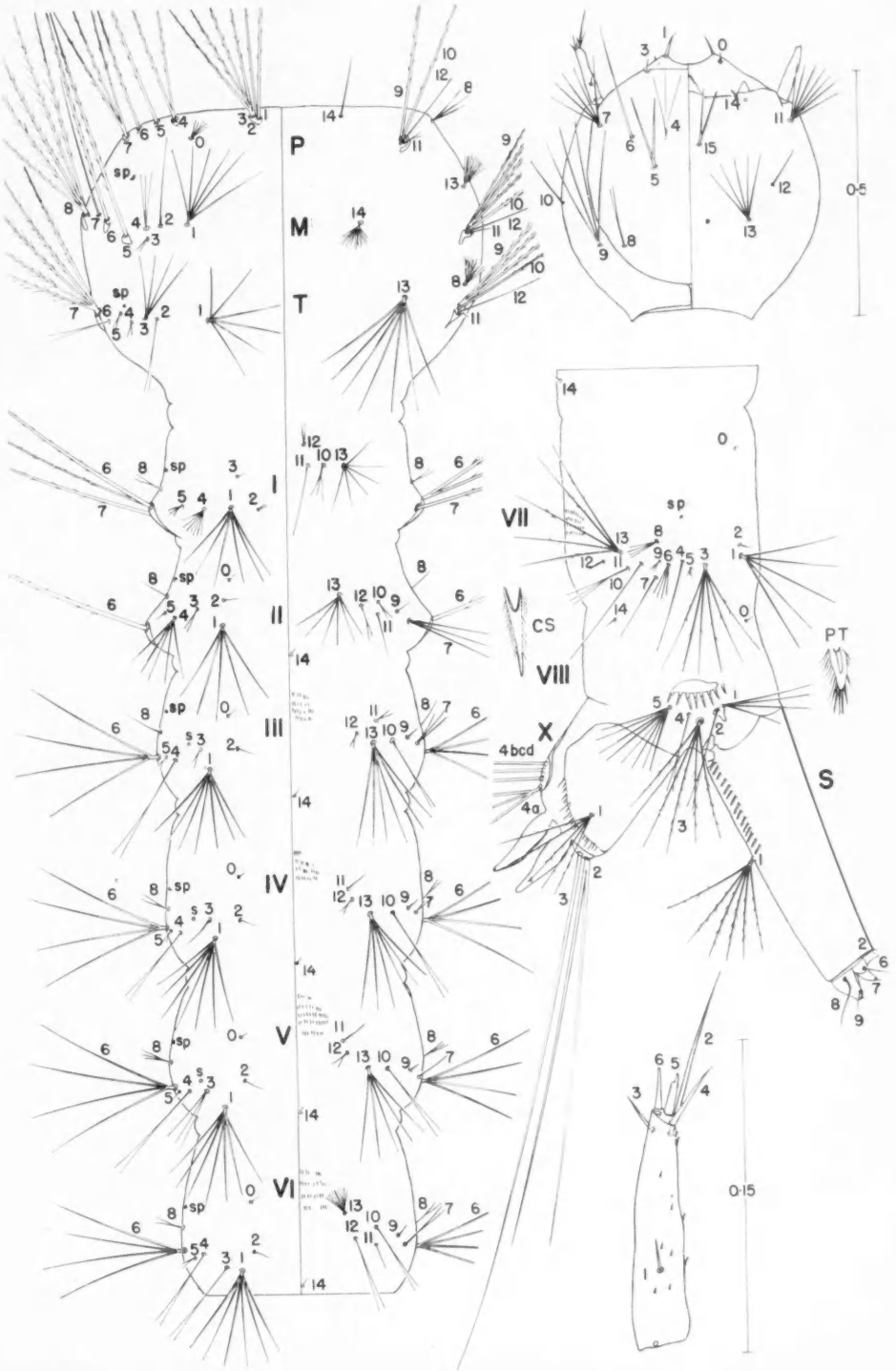
Head: 0.39 mm. Siphon: 0.37 mm. (sclerotized part about 0.34 mm.). Anal saddle: 0.19 mm. Specimens studied: 16.

Head: Width about 0.94 of length, greatest beyond middle; no distinct ocular bulge; pigmentation uniformly dark brown to almost black except for lighter ocular areas and very narrow dense black occipital ring; integumentary imbricate sculpturing well developed, uniform, weaker in ocular areas. Collar completely absent. Labrum well developed, slightly less than 0.4 of width at 1-C; median emargination usually greater than shown on figure. Mental plate small, prominent, heavily sclerotized and black anteriorly; one strong median tooth and at least 5 distinct teeth on each side. Hairs of head capsule darker than integument; relative position, length and degree of development as figured; hairs 5, 6 single, basal part heavy and finely barbed or fringed, distal part acutely tapered; 7, 9, 11, 13, 15 frequently finely fringed or minutely barbed; 7, 9 usually 3, 4b; 11 usually 4–7b; 13 usually 3–5b; 14 small, peglike; 15 usually 1, 2b; 8, 10, 12 single or 2b, f. Antenna about 0.23 of head; distinctly narrowed beyond 0.6; pigmentation as on head capsule; spicules small, sparse, darker than integument; all hairs single, dark, except apex of 5-A; 1-A at about 0.3–0.4, usually distinctly shorter than shaft width; basal sense organ prominent.

Thorax: Integument as in the first instar; larger hairs darkly pigmented, with strong basal tubercles and with long delicate fringes or barbs; hairs 1, 2, 3-P and 9–12-P, M, T with common tubercles; relative position, length and degree of development of hairs as figured; hairs 1-M, T and 13-T stellate tufts; 1, 2, 5, 6, 9, 10-P, 5, 7, 10, 12-M, and 10-T always single; 13, 14-M and

EXPLANATION OF PLATE III

FIG. 4. Third instar larva of *Uranotaenia a. anhydor* Dyar, Saratoga Springs population. Dorsal (left) and ventral (right) aspect of head, thorax and proximal abdominal segments, left lateral aspect of terminal abdominal segments, and dorsal aspect of left antenna.


P
M
T
I
II
III
IV
V
VI
VII
VIII
X
CS
PT
S
4bcd
4a
sp
0·5
0·15

8-T irregularly dendritic; 3-P usually 2, 3b; 7-P usually 2b; 8-P usually 2, 3b; 2-M single or 2f; 3, 4-M usually 2f; 2-T single or 2f; 3-T usually 2, 3b; 4-T usually 2b; 6-T single or 2f; other hairs usually single; hairs 8-M, 7-T absent. Meso- and metathoracic spiracle rudiments developed as small sclerotized spots.

Abdomen: Integument as in the first instar, ventral spicules reduced in number on II; segments I and II with sclerotizations near hairs 6 and 7; relative position, length and degree of development of hairs as figured; hairs 1-I-VIII stellate, usually 3, 4b; 6-I, II usually 2b; 7-I single; 7-II moderate, 2b; 6-III-VI moderate, stellate, usually 3b; 13-I, II usually 3b; 13-III-V, VII usually 4b; 13-VI irregularly dendritic. Hair 9 absent on I-VII. Segment VIII: comb plate small, restricted to bases of scales; comb scales usually 7 or 8, one or more not attached to plate; individual scale tapered apically, fringed laterally but with smooth apex; a common sclerotization at base of hairs 1 and 2; hair 3 fringed or barbed. Siphon: as figured; not sclerotized at extreme base; index 3.6–4.0 sclerotized portion light brown, darker at base; pecten extending to level of hair 1 or slightly beyond; teeth elongate, usually 12 to 14, distinctly and strongly fringed apically, indistinctly minutely fringed laterally; one small tooth often on unsclerotized part; hair 1-S at about 0.45, sparsely fringed or barbed, usually 4b; hair 8-S present, single, well developed, hooklike; other hairs as in first instar; acus of two connected sclerotizations, distal attached to sclerotized part of siphon. Segment X: saddle incomplete, dark brown, darker dorsocaudad, imbrications well developed; width 0.55–0.62 length; caudal margin with mixed small spines and spicules of varying sizes merging into spicules arising from imbrications more basally; gills as in the first instar, about 0.55 saddle length; hair 1 usually 3–5b, distinctly fringed; hair 2 about 3.5 saddle length, smooth, usually 2b; hair 3 single, smooth, about 4.2 saddle length; ventral brush represented by 4a (usually 2b) and 4b (single), both smooth; barred area of ventral brush poorly developed, not attached to saddle. Spiracular rudiments developed on I-VII. Dorsal sensilla on III-V not developed.

Other populations

A single larva from San Antonio, Texas appears to be very similar to the Saratoga Springs material except for a lighter pigmentation of sclerotized parts and hairs.

6. *Third Instar Larva*

Saratoga Springs population (Fig. 4)

Head: 0.56 mm. Siphon: 0.52 mm. Anal saddle: 0.25 mm. Specimens studied: 20.

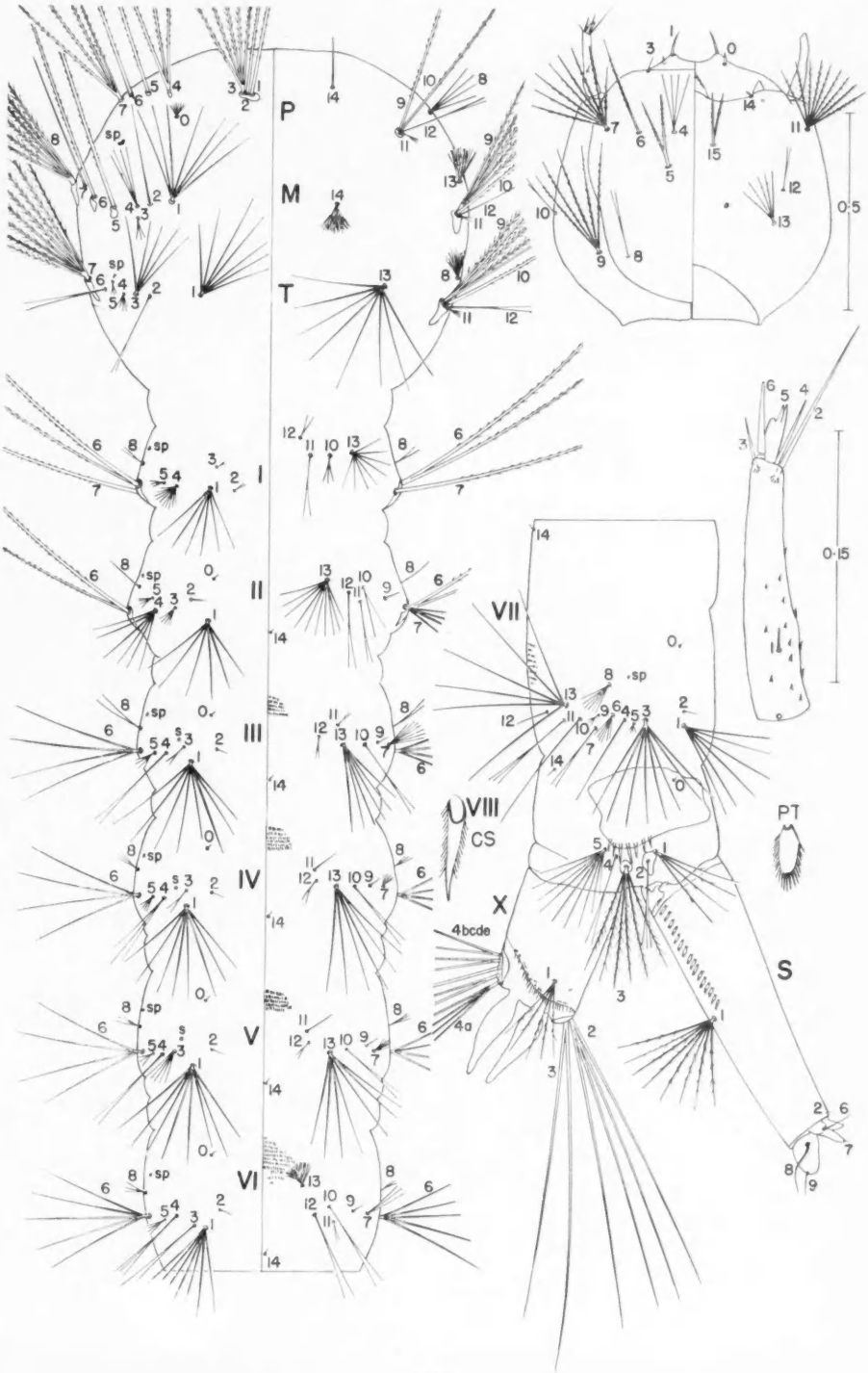
Head: Width about 0.96 of length, greatest beyond middle (figure incorrect in this respect); pigmentation extremely dark, almost black, except for lighter ocular areas; integumentary imbricate sculpturing well developed, uniform, weaker in ocular areas. Collar completely absent. Labrum well developed, about 0.31 width at 1-C; median emargination often deeper than shown in figure. Mental plate small, prominent; heavily sclerotized and black anteriorly; one strong median tooth and about 7 or 8 distinct teeth on each side. Heavier hairs of head capsule even more strongly pigmented than integument, usually strongly but minutely barbed; relative position, length and degree of development as figured. Antenna about 0.23 of head, gradually narrowed to apex; pigmentation as on head capsule; spicules small, sparse; basal sensillum distinct. Antennal hairs lighter than shaft; apex of 5-A transparent; relative position, length and degree of development as figured; all single; 1-A near basal third.

Thorax: Integument smooth, nude, unpigmented. Larger hairs strongly pigmented and fringed or barbed, provided with more or less well-developed basal tubercles; smaller hairs moderately pigmented, without tubercles; relative position, length and degree of development as figured; branching apparently as variable as in fourth instar; all hairs present, 7-T and 8-M appearing for the first time. Rudimentary spiracles distinct.

Abdomen: Integument smooth, nude, unpigmented except for about 4 or 5 ventral median rows of spicules on III-VII; segments II,III with strong lateral sclerotized plate at base of hairs 6 and 7. Hairs 6-I, II and 7-I distinctly fringed or barbed; other hairs nude or very minutely barbed; relative position, length and degree of development as figured; branching apparently as variable as in fourth instar; all hairs present, hair 9 appearing for the first time on I-VII. Segment VIII: comb plate small, well pigmented, with imbricate sculpturing, restricted to base of scales; one scale often free; scales usually 7 or 8, elongate, sharply pointed at apex, with distinct lateral fringes but smooth apically; a distinct small, sclerotized plate at base of hairs 1, 2-VIII. Siphon: as figured; index 3.5-4.2; extreme base not completely sclerotized; sclerotized part light brown, dark at base; imbricate sculpturing uniform, moderately distinct; pecten extending to about level of hair 1-S; teeth 12 to 18, elongate, distinctly fringed apically and laterally, all attached to sclerotized part; acus usually with long connection to sclerotized siphon; hair 1-S at about 0.45, usually 6b, delicately fringed;

EXPLANATION OF PLATE IV

FIG. 5. Fourth instar larva of *Uranotaenia a. anhydor* Dyar, Saratoga Springs populations. Dorsal (left) and ventral (right) aspect of head, thorax and proximal abdominal segments, left lateral aspect of terminal abdominal segments, and dorsal aspect of left antenna.


P
M
T
I
II
III
IV
V
VI
VII
VIII
CS
X
PT
S
sp
4bcde
4a
0·5
0·15

valve hairs as in second instar. Segment X: saddle incomplete, light brown, darker dorsoapically; median width about 0.7 length; imbrications moderately distinct; apical margin with small spines and spicules of varying lengths preceded by spicules arising from imbrications; gills subequal, narrowed and rounded apically, about 0.66 saddle length; hair 1-X usually 5b; 2-X about 3.5 saddle length, 2b, smooth; 3-X about 4.2 saddle length, single, smooth; ventral brush represented by 4a (usually 3b) and 4b, c, d (all usually single, occasionally 2b), all hairs smooth; barred area well developed, prolonged basally as a bar, not connected with saddle. Spiracular rudiments present on I-VII. Dorsal sensillum present on III-V, between and cephalad of hairs 3 and 4.

Other populations

Four specimens from San Diego, California cannot be distinguished from the Saratoga Springs population except for the somewhat lighter pigmentation of the head.

Two specimens from San Antonio, Texas appear to differ only in much lighter pigmentation of sclerotized parts and hairs.

7. *Fourth Instar Larva*

Saratoga Springs population (Fig. 5)

Head: 0.68–0.72 mm. Siphon: 0.72–0.80 mm. Anal saddle: about 0.32 mm. Specimens studied: 85.

Head: About as wide as long; ocular bulge moderately developed (not shown in figure because of flattening); pigmentation uniformly very dark brown, almost black, except for light ocular areas; imbricate integumentary sculpturing well developed, uniform, lighter in ocular areas; collar not developed. Labrum well developed, about 0.3 of width at 1-C. Mental plate small, prominent; heavily sclerotized and black anteriorly; with one prominent median tooth and 6 to 9 distinct teeth on each side. Heavier hairs extremely dark, practically black, with short barbs; weaker hairs dark brown, without visible barbs; relative position, length and degree of development as figured; hair 0(1; small, transparent, leaflike and pointed), 1(1; lightly pigmented, slender, moderately curved), 2(not developed), 3(1; thin, difficult to see), 4(4, 3, 5b; 4.74; 3–7), 5(3, 2b; 2.56), 6(1; 1.05; 1–2), 7(8, 7, 9b; 7.9; 6–11), 8(2f, 1; 1.64; 1–3), 9(5, 6b; 5.48; 5–7), 10(2f; 1.77; 1–2), 11(9, 8, 10b; 9.10; 7–11), 12(2f; 2.21; 2–3), 13(5, 4b; 4.95; 2–7), 14(1; small, peglike), 15(2b). Antenna about 0.24 of head; distinctly narrowed at about middle; pigmentation even darker than on head capsule, uniform except for slightly lighter apex and completely black base; spicules small, sparse, very dark. Antennal hairs slightly lighter than integument except for transparent apex of 5-A; all hairs simple; relative position, length and degree of development as figured; hair 1-A usually minute, extremely difficult to see, usually about 0.50 of shaft width, position variable but usually within basal third; basal sensillum distinct.

Thorax: Integument smooth, nude, unpigmented; larger hairs strongly pigmented but lighter than on head capsule, with basal tubercle plates and short fringes or barbs; smaller hairs moderately pigmented, without tubercles or conspicuous fringes or barbs; relative position, length and degree of development as figured; hair 1-P about as long as head capsule, 3-P about 0.8 of hair 1-P; hairs 1-M, T and 3, 13-T with uneven branches. Rudimentary spiracles distinct. Prothorax; hair 0(8, 7, 9, 6b; 7.88; 6–11), 1(1), 2(1), 3(5, 6, 4b; 5.16), 4(3, 4b; 3.33), 5(1), 6(1), 7(4b; 4.08; 3–5), 8(4, 5, 3b; 3.92; 2–6), 9(1), 10(1), 11(3, 4b; 3.44; 2–5), 12(2f; 2.05; 1–3), 14(1). Mesothorax: hair 1(7, 8b; 7.16; 5–9), 2(1), 3(3, 4b; 3.54; 3–5), 4(4, 3b; 3.67; 2–5), 5(1), 6(1), 7(1), 8(6, 7, 5b; 6.03), 9(5, 6b; 5.21; 4–7), 10(1; 1.03; 1–2), 11(3, 4b; 3.15; 2–4), 12(1), 13 (about 20–25d), 14 (about 25–30d). Metathorax: hair 1(7, 8b; 7.41; 6–9), 2(2, 3b; 2.45; 1–4), 3(5b; 4.92; 4–6), 4(5b; 4.72; 3–7), 5(3, 2b; 2.56; 1–4), 6(2f; 1.94; 1–3), 7(8, 9b; 8.60; 7–11), 8(11–20b), 9(4b; 3.92; 3–5), 10(1; 1.08; 1–2), 11(4, 3b; 2.71; 3–5), 12(2, 1–3b; 2.0), 13(8, 9b; 8.0; 6–10).

Abdomen: Integument smooth, nude and unpigmented except for 5 or more ventral median rows of small spicules on III–VII; segments I and II each with strong lateral sclerotized plate at base of hairs 6 and 7. Hairs 6–I, II and 7-I with numerous barbs or short fringes; other hairs nude or very minutely barbed except as noted; stellate hairs with uneven branches; relative position, length and degree of development as figured. Segment I: hair 1(6, 7b; 6.35; 5–7), 2(3, 2b; 2.40; 1–5), 3(2b; 1.92; 1–3), 4(9, 10, 8–12b; 9.60; 6–12), 5(4, 3b; 4.0; 3–6), 6(2b; lower branch weaker and shorter), 7(1; 1.05; 1–2), 8(2, 3b; 2.30; 1–3), 9 (not developed), 10(3, 2b; 2.67; 1–5), 11(2f; 1.90; 1–2), 12(2, 3b; 2.35; 2–4), 13(6, 9, 8, 7b; 7.64; 5–13), 14 (not developed). Segment II: hair 0(1), 1(6, 7b; 5.90; 5–8), 2(1), 3(5, 7, 4b; 5.58; 3–10), 4(6, 5b; 5.81; 4–7), 5(4, 3b; 3.81; 3–5), 6(2b; lower branch weaker and shorter), 7(4, 3b; 3.46; 2–4), 8(1, 2f; 1.32; 1–2), 9(1), 10(2b; 2.36; 1–4), 11(2f; 1.95; 1–3), 12(2f), 13(10, 8–11b; 9.56; 7–12), 14 (not developed). Segment III: hair 0(1), 1(8, 7b; 7.59; 6–9), 2(1), 3(2, 3b; 2.35; 1–4), 4(2, 3f; 2.38; 2–4), 5(4, 5b; 4.38; 3–6), 6(4, 5b; 4.43; 4–6), 7(7, 8, 6, 5b; 6.64; 3–9), 8(2f; 1.97; 1–3), 9(1), 10(2f; 1.79; 1–2), 11(2, 1–3f; 2.0), 12(2f; 2.18; 2–3), 13(6, 7b; 6.48; 5–8), 14(1; 1.05; 1–2). Segment IV: hair 0(1), 1(8, 7b; 7.40; 6–8), 2(1), 3(2f, 1; 1.85; 1–3), 4(3, 2b; 2.65), 5(4, 3b; 3.68; 2–5), 6(4b; 3.51; 3–5), 7(7, 5–6, 8b; 5.68; 3–8), 8(3b; 2.88; 2–4), 9(1), 10(2b; 1.92; 1–2), 11(1), 12(2f; 2.03; 1–3), 13(6, 5b; 5.65), 14(1). Segment V: hair 0(1), 1(8, 7b; 7.51; 6–9), 2(1), 3(5–7b; 5.56; 3–9),

4(2f; 1.95; 1–3), 5(3, 4b; 3.63; 2–6), 6(4, 5b; 4.26; 3–5), 7(6, 5, 7b; 5.84; 3–9), 8(3b; 2.92; 2–4), 9(1), 10(2b; 1.82; 1–3), 11(1; 1.10; 1–2), 12(2f; 1.97; 1–2), 13(7b; 6.78; 5–8), 14(1). Segment VI: hair 0(1), 1(7–8, 6b; 7.23; 4–9), 2(1; 1.03; 1–2), 3(2, 3b; 2.37; 2–4), 4(3, 2f; 2.75; 2–4), 5(4, 3–5b; 3.92; 2–5), 6(6, 4, 5b; 4.77; 3–7), 7(2, 3b; 2.62; 2–4), 8(3, 2b; 2.56; 2–3), 9(1; 1.05; 1–2), 10(2f; 1.75; 1–2), 11(2f; 1.91; 1–2), 12(2b; 1.74; 1–2), 13(10–24d), 14(1; 1.03; 1–2). Segment VII: hair 0(1), 1(6, 5–7b; 5.95; 4–8), 2(1), 3(8, 7, 9b; 7.57; 6–9), 4(1; 1.23; 1–2), 5(4, 5b; 4.62; 3–6), 6(6, 7b; 6.70; 6–9), 7(2–3b; 2.59; 2–4), 8(6, 7b; 6.54; 5–8), 9(3, 4b; 3.28; 2–4), 10(1, 2f; 1.41), 11(3f; 3.28; 2–4), 12(1), 13(6, 5b; 5.65; 4–7), 14(1; 1.03; 1–2). Segment VIII: comb plate large, including hair 0–VIII, lightly pigmented, darker along margins, with distinct imbricate sculpturing, irregularly truncate ventrally; all scales attached; scales (8, 7; 7.75; 6–10), black, sharply pointed at apex, with distinct lateral fringes but smooth apically; hairs 1, 2–VIII with a small common basal plate; hair 3–VIII with conspicuous fringes and a minute basal plate; hair 0(1), 1(4, 5b; 4.50; 4–6), 2(3, 2f; 2.62; 1–4), 3(6, 5b; 5.97; 5–8), 4(2, 3f; 2.26), 5(9, 10b; 9.02; 7–10), 14(1; 1.05; 1–3). Siphon: usually differently shaped from figure, with dorsal surface concave, ventral convex; index 3.8–5.0; completely sclerotized; pigmentation a very light yellowish brown, somewhat darker apically, a narrow black ring at base; imbricate sculpturing uniform, rather indistinct; pecten extending to about level of hair 1-S; teeth (16–17, 18; 16.65; 13–20), elongate but with expanded lateral margins, fringed apically and laterally; acus with short connection to siphon; hair 1-S at about 0.45, delicately fringed; hair 1(8, 9, 10b; 8.44; 6–11), 2(1; minute, at extreme apex of siphon), valve hairs as figured, not studied in detail, apparently all single, 13 (1; minute, peglike; never with twisted base). Segment X: saddle completely ringing segment; light brown, somewhat darker than siphon, darkened proximally; median width about 0.76 length; imbrications uniform, more distinct than on siphon; apical margin with small spines and spicules of varying lengths preceded by spicules arising from imbrications; caudal margin strongly emarginate in region of ventral brush; gills subequal; narrowed and rounded apically, about 0.7 saddle length; hair 1(5b; 4.95; 4–8; delicately fringed), 2(4, 3b; 3.65; 3–5; about 2.8 saddle length, smooth), 3(2b; about 3.4 saddle length, smooth), ventral brush represented by 4abcde, all smooth, 4a(4, 5b; 4.57; 3–6; about 1.6 saddle length), 4b(2b; about 1.7 saddle length), 4c(1; 1.05; 1–2; about 3.0 saddle length), 4d(2b; 1.97; 1–3; about 3.0 saddle length), 4e(2b; 2.07; 2–3; about 1.5 saddle length); barred area well developed, with strong lateral sclerotized plates and a median caudal bar uniting it to saddle. Spiracular rudiments present on I–VII. Dorsal sensillum present on III–V, usually between and cephalad of hairs 3 and 4.

Variation. We have noted considerable variation in the shape and size of all the sclerotized parts but the pigmentation appears to be quite uniform. Specimens reared from eggs in the laboratory tend to have a somewhat lighter head capsule; however, the pigmentation even then is stronger than we have seen in any specimen from other populations. The chaetotaxy is quite variable as indicated in the above description which is based on the study of the complete chaetotaxy of 10 skins from individually reared field-collected fourth instar larvae and 10 whole fourth instar larvae collected in a different breeding site. Although there appear to be significant differences in the two samples in the mode and mean of the number of branches in several hairs, we have combined these data for the characterization of the Saratoga Springs population and for comparison with other populations. Several hairs which have been suggested as diagnostic for *anhydor* or *syntheta*, or which showed promise of separating the Saratoga Springs population from others, were examined in 65 additional skins from individually reared field-collected fourth instar larvae from both breeding sites. The data on these hairs were combined with those from the first two samples and are presented in Table I in the hope that they may prove of value when comparable samples of other populations can be studied.

San Diego population

The three mounted larval skins examined are so badly twisted that it is difficult to identify all the hairs. However, we believe that we have interpreted the majority of the hairs correctly. The chaetotaxy shown in the figures of Galindo, Blanton and Peyton (1954: 123) is quite different, but it was probably obtained from the same material. None of the specimens we examined had hair 4–P two-branched, hair 5–VIII three-branched. In addition we have never seen a comb plate as pictured by these authors.

Pigmentation of the head capsule and antenna lighter, of the siphon and saddle darker. Siphon index about 5.0. Head capsule: hair 0(1), 1(1), 3(1), 4 (missing), 5(2b, 1), 6(1), 7(8b), 8(2f), 9(5b; 5–7), 10(2f), 11(10b), 12(3, 4b), 13 (missing), 14(1), 15(2b). Antenna: all hairs single. Prothorax: hair 0(7b; 7–11), 1 (1), 2(1), 3(5b), 4(3, 4b), 5(1), 6(1), 7(4b; 4–5), 8(4b; 3–7), 9(1), 10(1), 11(4, 3b; 3–5), 12(2f), 14(1; 1–2). Mesothorax: hair 1(7b; 6–7), 2(1), 3(3, 4b),4(4, 3b), 5(1), 6(1), 7(1), 8(6, 7b), 9(6, 7b; 5–7), 10(1), 11 (missing), 12(1), 13 (over 25d), 14 (over 30d). Metathorax: hair 1(6, 7b), 2(1), 3(4, 5, 6b), 4(4b; 3–4), 5(3b; 2–3), 6(2f, 1–2), 7(10, 11b; 8–11), 8(15, 16b), 9(4b), 10(1), 11 (not seen), 12(2f; 1–3), 13(8b). Abdomen I: hair 1(7b), 2(2b), 3(2b), 4(11, 12b), 5(3, 4b), 6(2b), 7(1),

8(1), 10(3b), 11(1, 2f), 12(2b), 13(11b). Abdomen II: hair 0(1), 1(6b), 2(1), 3(3b), 4(6b), 5(4b), 6(2b), 7(4b), 8(1), 9(1), 10(2b), 11(2f), 12(2f), 13 (missing). Abdomen III: 0(1), 1(7b), 2(1), 3(2b), 4(2f), 5(4, 6b), 6(5b), 7(8, 12b), 8(2f), 9(1), 10(2f), 11(2f), 12(2f), 13(6b), 14(1). Abdomen IV: 0(1), 1(7, 9b), 2(1), 3(2f), 4(3b), 5(4, 5b), 6(4b), 7(6b), 8(2b), 9(1), 10(2b), 11, 12 (not seen), 13(5b), 14(1). Abdomen V: 0(1), 1(7, 8b), 2(1), 3(7, 8b), 4(2f), 5(4b), 6(4b), 7(7, 8b), 8(2, 3b), 9(1), 10(2b), 11(2f), 12(2f), 13(6b), 14(1). Abdomen VI: 0(1), 1(7, 8b), 2(1), 3(2, 3b), 4(3b), 5(5b), 6(5, 6b), other hairs not seen. Abdomen VII: 0(1), 1(5, 6, 7b), 2(1), 3(6, 8b), 4(1, 2f), 5(3, 4, 5b), 6(7, 6b), 7(2, 3f), 8(6, 7, 8b), 9(2, 3b), 10(1), 11(3, 2b), 12(1), 13(5b), 14(1). Abdomen VIII: scales (9, 10, 8), hair 0(1), 1(4, 5b), 2(2, 3f), 3(6, 5b), 4(2f), 5(10b; 6–10), 14(1). Siphon: pecten teeth (17; 16–20); hair 1(10, 9b); 2(1); valve hairs all single. Segment X: hair 1(5b), 2(3b), 3(2b), others missing or not seen.

Bonsall population

A single mounted larval skin was examined. It appears to be quite similar to the San Diego specimens. Unfortunately it is also badly twisted and the siphon is so flattened that its index cannot be determined.

Pigmentation of the head capsule is intermediate between the San Diego and Saratoga Springs populations. The siphon and anal saddle appear to be darker than in the Saratoga Springs specimens. Head capsule: hair 0(1), 1(1), 3(1), 4 (missing), 5(2b), 6 (missing), 7(7b), 8 (missing), 9(6b), 10 (missing), 11(11b), 12(3b), 13 (missing), 14(1), 15(2). Antenna: pigmentation as in Saratoga Springs population; all hairs single. Prothorax: hair 0(8, 9b), 1(1), 2(1), 3(5b), 4(3b), 5(1), 6(1), 7(4b), 8(3b), 9(1), 10(1), 11 (not seen), 12 (not seen), 14 (missing). Mesothorax: hair 1(6b), 2(1), 3(4b), 4(3b), 5(1), 6(1), 7(1), 8(7b), 9(5, 6b), 10(1), 11(5b), 12 (missing), 13 (about 20d), 14 (about 25d). Metathorax: hair 1(6, 7b), 2(1), 3(4b), 4(4b), 5(2b), 6(2f), 7(8, 10b), 8(14, 16b), 9(3, 4b), 10(1), 11 (not seen), 12 (missing), 13(7b). Abdomen I: hair 1(7b), 2(1), 3(2b), 4(7b), 5(4b), 6(2b), 7(1), other hairs not identified. Abdomen II–VII: skin twisted, hairs not identified. Abdomen VIII: scales 8, 9; hair 0(1, 2b), 1(4b), 2(3f), 3 (not seen), 4(2f), 5(7b), 14(1). Siphon: pecten teeth 16, 17; hair 1(9b), 2(1), valve hairs all single. Abdomen X: hair 1(4, 5b), 2(1, 2b), 3(2b), 4a(5b), 4b(2b) 4c(1), 4d(2), 4e (not seen).

Arizona population

A single whole larva from St. David is very similar to the Saratoga Springs material but distinctly larger. The head capsule is almost as dark and the comb plate and anal saddle are darker. The ocular bulge is very prominent.

Head: 0.75 mm. Siphon: 0.82 mm.; index slightly less than 5.0. Anal saddle: 0.37 mm. Head capsule: hair 0 (not seen), 1(1), 3 (not seen), 4(4b), 5(2, 3b), 6(1), 7(7, 8b), 8(2f), 9(6b), 10(2f), 11(7, 10b), 12(2b), 13(4, 5b), 14 (not seen), 15(2b). Antenna about as dark as head capsule; all antennal hairs single. Prothorax: hair 0(7, 8b), 1 (missing), 2(1), 3(5b), 4(2, 3b), 5(1), 6(1), 7(4b), 8(3, 4b), 9(1), 10(1), 11(3, 4b), 12(2f), 14(1). Mesothorax: hair 1(6, 7b), 2(1), 3(3b), 4(3b), 5(1), 6(1), 7(1), 8(6, 7b), 9(4b), 10(1), 11 (not seen), 12(1), 13 (about 20d), 14 (about 25d). Metathorax: hair 1(7b), 2(2b), 3(4, 6b), 4(6, 7b), 5(2, 3b), 6(2f), 7(9b), 8(15, 18b), 9(3, 4b), 10(1), 11 (not seen), 12(2, 3f), 13(7, 8b). Abdomen I: hair 1(6, 7b), 2(2b), 3(1), 4(8, 12b), 5(4, 5b), 6(2b), 7(1), 8(2f), 10(2f), 11 (not seen), 12 (not seen), 13(7b). Abdomen II: hair 0(1), 1(6b), 2(1), 3(4, 5b), 4(6b), 5(3, 4b), 6(2b), 7(2, 3b), 8(1), 9(1), 10(3b), 11(2f), 12(2f), 13(9, 13b). Abdomen III: hair 0(1), 1(7, 8b), 2(1), 3(2, 3f), 4(2f), 5(5b), 6(4b), 7(7b), 8(2b), 9(1), 10(2f), 11(2f), 12(2f), 13(5b), 14 (not seen). Abdomen IV: hair 0(1), 1(6, 7b), 2(1), 3(1), 4(3b), 5(4b), 6(4b), 7(5b), 8(3b), 9(1), 10(2b), 11(1), 12(2f), 13(6b), 14 (not seen). Abdomen V: hair 0(1), 1(7b), 2(1), 3(6b), 4(2f), 5(2, 4b), 6(3b), 7 (not seen), 8(2b), 9(1), 10(1, 2f), 11(1), 12(2f), 13(5b), 14(1). Abdomen VI: hair 0(1), 1(7b), 2(1), 3(2, 3f), 4(3f), 5(4b), 6(5, 6b), 7(3b), 8(2b), 9(1), 10(2b), 11(2b), 12(2f), 13(18, 20d), 14(1). Abdomen VII: hair 0(1), 1(6b), 2(1), 3(8, 9b), 4(1), 5(4b), 6(8, 9b), 7(1, 2f), 8(7b), 9(4b), 10(1), 11(2, 3f), 12(1), 13(5b), 14(1). Abdomen VIII: comb scales 7, 8; hair 0(1), 1(4, 5b), 2(2f), 3(6, 8b), 4(2f), 5(8, 9b), 14 (not seen). Siphon: pecten teeth 14, 15; hair 1(9, 10b), 2(1); valve hairs all single. Abdomen IX: hair 1(5b), 2, 3 (missing), 4a(5b), 4b(2b), 4c(1), 4d(2b), 4e(2b); gills subequal, about 0.84 saddle length.

Texas populations

Fifty-seven whole larvae and larval skins from Luling and San Antonio were examined. The chaetotaxy of 10 specimens was determined in its entirety and 13 additional specimens were examined for certain hairs for comparison with the Saratoga Springs population (Table I).

In general *syntheta* larvae are closer morphologically to the Saratoga Springs population than to any of the other *anhydor* populations examined. They differ principally in the lighter coloration (darker than San Diego) of the head capsule, darker coloration of the siphon, comb plate and anal saddle, in their slightly larger size, and in the branching of some hairs.

Head: 0.70–0.75 mm. Siphon: 0.90 mm., index 4.6–5.2. Anal saddle: 0.35 mm. Head capsule: hair 0(1), 1(1), 3(1), 4(4, 3–5b; 4.0), 5(2b; 2.0; 1–3), 6(1), 7(7, 6b; 7.0; 6–9), 8(2f; 2.06; 2–3), 9(6, 5b; 5.61; 4–8), 10(2f, 1; 1.71; 1–4), 11(7, 10–8b; 7.94; 5–10), 12(2b; 2.11; 2–3),

TABLE I

BRANCHING OF SELECTED LARVAL HAIRS

HAIR	*Saratoga Springs Population* (170 hairs)					*Texas Populations* (44 hairs)				
	MODE*	RANGE	MEAN	SD	SE	MODE*	RANGE	MEAN	SD	SE
5-C	2, 3	1–4	2.48	0.36	0.03	2, 3	1–3	2.09	0.49	0.09
6-C	1	1–2	1.11	.32	.02	1	1	1	0	0
7-C	8, 7, 9	6–11	7.92	.93	.07	7, 8, 6	6–9	7.26	1.06	.16
11-C	9, 8, 10	6–11	8.86	1.02	.08	7, 9, 8, 10	5–10	7.91	1.34	.23
3-P	5, 4	3–6	4.86	.63	.05	5, 6, 4	3–7	4.91	.95	.17
4-P	3, 4	2–4	3.22	.24	.02	3	2–4	3.07	.69	.13
7-P	4	3–5	4.03	.40	.03	4	3–5	4.00	.46	.07
1-T	7, 8	5–10	7.52	.66	.06	7, 8	6–9	7.45	.75	.13
7-T	8, 9, 10	7–12	8.76	1.03	.08	8, 9, 7	7–11	8.33	.91	.15
2-I	2, 3	1–5	2.36	.62	.05	5, 3–4	3–7	4.35	.98	.17
4-I	8–12	6–13	10.09	1.51	.12	9–13	8–14	11.38	1.63	.28
3-II	5, 6, 7	3–10	5.70	1.13	.09	5, 6	4–9	5.83	1.32	.22
13-II	10, 8–12	7–15	10.00	1.54	.12	10, 11, 9	7–13	10.00	1.22	.21
13-III	6, 7	5–8	6.33	.44	.04	6, 5, 7	4–8	5.94	1.11	.19
5-VIII	9, 10, 8	6–11	8.99	.88	.07	7, 8	5–10	7.72	1.20	.20
1-S	8, 9, 7	6–12	8.42	1.04	.08	8, 9, 7–10	7–11	8.54	1.08	.18
Scales	8, 7, 9	6–10	7.79	.95	.07	8, 7	6–9	7.75	.76	.11

*Usual number of branches, in order of frequency, representing 75% or more of total.

13(4, 5b; 4.56; 3–7), 14(1), 15(2). Antenna: pigmentation darker than head capsule; all hairs single. Prothorax: hair 0(7–10b; 8.44; 6–12), 1(1), 2(1), 3(6, 5b; 5.43; 4–7), 4(3, 4, 2b; 3.08), 5(1), 6(1), 7(4b; 3.75; 3–4), 8(3, 4b; 3.39), 9(1), 10(1), 11(4, 3b; 3.54; 2–4), 12(2f, 1; 1.88; 1–3), 14(1; 1.05; 1–2). Mesothorax: hair 1(7, 8b; 7.19; 6–8), 2(1), 3(3, 4b; 3.74; 3–6), 4(3, 4b; 3.56), 5(1), 6(1), 7(1), 8(5, 6b; 5.79; 5–9), 9(6, 5, 4b; 5.19; 4–7), 10(1), 11(4b; 3.83; 3–4), 12(1), 13 (about 25d), 14 (about 35d). Metathorax: hair 1(8, 7b; 7.53; 6–9), 2(2b; 2.20; 2–4), 3(5, 4b; 4.64; 3–6), 4(4, 5b; 4.42; 3–6), 5(2, 3b; 2.16; 1–3), 6(2f, 1; 1.71), 7(8, 9–7b; 8.31; 7–11), 8(15–13b; 14.33; 11–19), 9(4b; 3.93; 3–5), 10(1), 11(4, 2–3b; 3.40), 12(2f; 2.07; 1–2), 13(7,9b; 8.0; 7–10). Abdomen I: hair 1(7, 6b; 6.40; 4–7), 2(3–4, 5b; 3.94); 3(2b; 1.84; 1–3), 4(11, 12, 9–14b; 11.25; 8–14), 5(4, 5, 3b; 4.00), 6(2b), 7(1), 8(2b; 2.10; 2–3), 10(3, 4, 2b; 3.00), 11(2b; 1.83; 1–2); 12(2, 3b; 2.41), 13(7, 6, 8b; 7.05; 6–9). Abdomen II: hair 0(1), 1(6.7b; 6.20; 5-7), 2(1), 3(5, 6b; 5.61; 4–9), 4(6, 7b; 6:20; 5–7), 5(4b; 3.77; 3–4), 6(2b), 7(4, 3b; 3.81; 3–5), 8(1), 9(1), 10(3, 2b; 2.94; 2–5), 11(2f), 12(2f), 13(10, 11b; 10.73; 9–13). Abdomen III: hair 0(1), 1(8, 6–7b; 7.08; 5–9), 2(1; 1.05; 1–2), 3(3, 2b; 2.67), 4(2f; 1.94; 1–2), 5(4, 5b; 4.22; 3–5), 6(4b; 4.06; 3–5), 7(7, 5, 8b; 6.77; 5–9), 8(2b; 1.70; 1–2), 9(1), 10(2f; 1.71; 1–2), 11(3, 2f; 2.46; 1–3), 12(2, 3f; 2.17; 1–3), 13(6, 5b; 6.10; 5–8), 14(1). Abdomen IV: hair 0(1), 1(7b; 6.93; 6–8), 2(1), 3(2, 3b, 1; 2.06), 4(3, 2b; 2.56; 1–3), 5(3, 4b; 3.53; 3–5), 6(4b), 7(6, 3, 7b; 5.0; 3–7), 8(3, 2b; 2.53), 9(1), 10(2b), 11(1), 12(2f; 2.19; 2–3), 13(5, 6b; 6.08; 5–7), 14(1). Abdomen V: hair 0(1), 1(7, 8b; 7.14; 6–8), 2(1), 3(6, 5, 7b; 5.88; 4–8), 4(2f), 5(3b; 3.20; 3–4), 6(4b; 3.92; 3–4), 7(7, 6, 8b; 6.38; 3–9), 8(2b; 2.12; 2–3), 9(1), 10(2f; 1.75; 1–2), 11(1; 1.07; 1–2), 12(2f; 2.14; 3–4), 13(6, 7b; 6.08; 5–7), 14(1). Abdomen VI: hair 0 (1), 1(6, 7–8b; 7.12; 6–9), 2(1), 3(2f; 2.0; 1–3), 4(3, 2f; 2.85; 2–4), 5(3b; 3.29; 3–4), 6(5, 4b; 5.12; 4–7), 7(3, 4b; 3.44; 3–5), 8(2b; 2.08; 2–3), 9(1), 10(2b; 1.75; 1–2), 11(2b, 1; 1.57), 12(2f; 1.75; 1–2), 13(12–28d), 14(1). Abdomen VII: hair 0(1), 1(6, 7, 5b; 6.19; 5–8), 2(1), 3(7, 8b; 7.36; 6–9), 4(1, 2f; 1.42), 5(3, 4b; 3.81; 3–6), 6(7, 6b; 6.53; 5–8), 7(3, 2b; 2.69), 8(6, 7b; 6.57; 5–8), 9(3b; 2.69; 2–3), 10(1; 1.07; 1–2), 11(3f; 3.24; 3–4), 12(1), 13(4, 5b; 4.81; 4–7), 14(1; 1.19; 1–2). Abdomen VIII: comb scales (8, 9; 8.05; 6–9); hair 0(1; 1.05; 1–2), 1(4b; 4.53; 4–7), 2(2f; 2.06; 1–3), 3(5b; 5.28; 5–6), 4(2f; 1.88; 1–2), 5(7, 8b; 8.0; 7–10), 14(1, 2b; 1.42). Siphon: pecten teeth (17, 14–20; 17.05; 14–21); hair 1(10, 7, 8b; 8.81; 7–11), 2(1), all valve hairs single except 6(1; 1.10; 1–3). Abdomen X: hair 1(5, 4–7–8b; 5.74), 2(3b; 3.06; 3–4), 3(2b), 4a(4, 5–6b; 4.6), 4b(2b), 4c(1), 4d(2b), 4e(2b; 2.15; 1–4); gills subequal or ventral slightly longer, variable in shape and length, 0.65–0.80 saddle length.

8. *Pupa*

Saratoga Springs population (Fig. 6a-h)

Abdomen: 2.4 mm. Trumpet: 0.42–0.56 mm. Paddle: 0.65 mm. Specimens studied: 81.

Cephalothorax: Lightly pigmented, darker on meso- and metanotum and base of appendage cases. Trumpet moderately pigmented except for very dark tracheoid; length and shape variable (fig. 6d-h), usually distinctly and abruptly flared at apex; length usually about 10.0 median width or more, rarely as little as 6.0; inner wall dis-

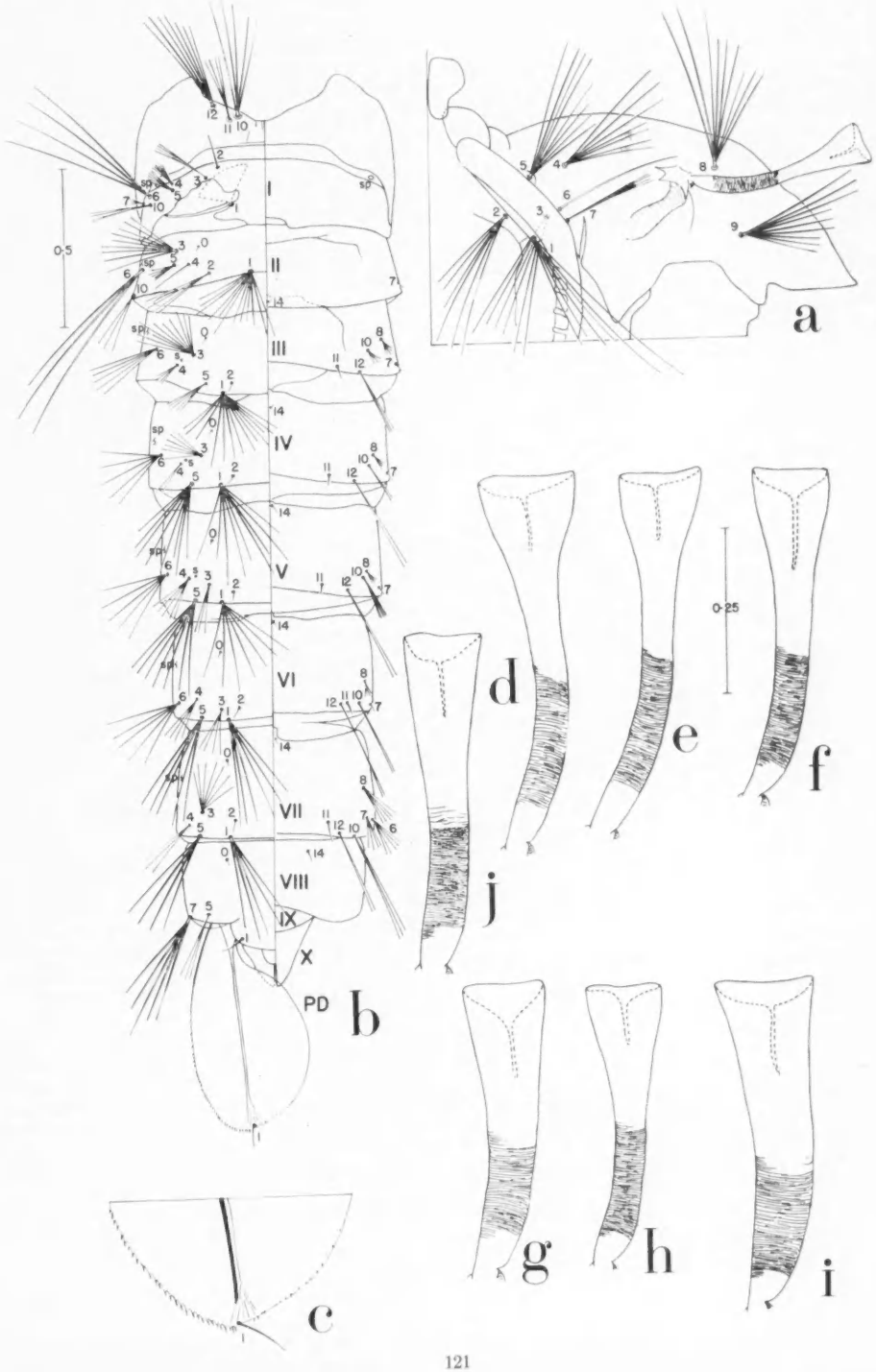
tinctly separated in pinna; tracheoid extending to slightly less than 0.5 on lateral surface, well developed on mesal surface, absent from base; reticulate usually indistinct; pinna usually very shallow, about 0.05–0.10; slit in meatus very narrow, usually extending about 0.2–0.3 trumpet length. Hairs strongly pigmented; relative position, length, and degree of development as figured; branches of larger hairs uneven in length and thickness, usually without conspicuous fringes except hairs 10 and 12. Hair 1(6, 5b; 6.11; 5–8), 2(6, 5b; 5.85; 4–7), 3(6, 7b; 6.30; 5–8), 4(7, 8, 6b; 7.05), 5(9, 8b; 8.05; 6–10), 6(1), 7(4, 3bf; 3.65), 8(10, 9, 11b; 9.55; 7–11), 9(10, 9b; 9.40; 8–11), 10(5, 4, 6b; 4.95; 3–7), 11(4–6b; 4.95; 3–7), 12(7, 8b; 7.20; 6–8).

Abdomen: Lightly to moderately pigmented, darker cephalad and on intersegmental areas; tergal and sternal spiculate areas as in other species of *Uranotaenia*. Rudimentary spiracles on II–VII small, located laterally on tergites; that of I large, located dorsally in intersegmental area caudad of metanotum. Dorsal sensilla present on III–V. Larger hairs strongly pigmented, smaller, lighter; all hairs usually smooth, without fringes or barbs, except as noted; larger hairs often with branches of uneven length and thickness; relative position, length and degree of development as figured. Segment I: hair 1 (compound palmate with 10–20 primary branches and total of 57–90 terminal branches), 2(1), 3(2–3, 4b; 3.0; 2–5), 4(6, 7, 8b; 6.90; 6–9), 5(6b; 6.11; 5–8), 6(3, 4b; 3.37; 2–5), 7(3, 2b; 2.60; 2–4), 10(4, 3b; 3.74; 3–5). Segment II: 0(1), 1(12, 11b; 11.60; 10–13; branches often of uneven length and thickness), 2(4, 3b; 3.70; 3–5), 3(9, 8, 10b; 8.85; 7–10),4(1), 5(5, 4b; 4.90; 4–7), 6(3b; 3.16; 2–4; usually the longest and strongest hair), 7(1), 10(3, 4b; 3.26; 2–4). Segment III: hair 0(1), 1(13, 14, 12b; 13.0; 10–15), 2(1), 3(10, 9, 11b; 9.70; 7–12), 4(4, 5b; 4.30; 3–6), 5(5, 4b; 4.75; 3–6), 6(5, 4b; 4.79; 3–6), 7(1), 8(5, 6b; 5.21; 4–6), 10(5-6b; 5.50; 4–7), 11(1), 12(2, 3bf; 2.42), 14(1). Segment IV: hair 0(1), 1(9, 10b; 9.21), 2(1), 3(6, 7b; 6.39; 5–8), 4(2, 3, 4b; 2.85), 5(8, 9b; 8.30; 6–11), 6(5, 6b; 5.40; 4–7), 7(1), 8(4, 5b; 4.47), 10(2bf; 2.20; 1–4), 11(1), 12(2, 3b; 2.26; 1–3), 14(1). Segment V: hair 0(1), 1(7, 8b; 6.90; 5–8), 2(1), 3(3, 4b; 3.61; 3–6), 4(5, 4b; 4.75; 3–6), 5(7, 6b; 6.55; 5–8), 6(5, 6b; 5.15; 4–6), 7(1), 8(4b; 4.11; 3–5), 10(5, 4b; 4.60; 2–6), 11(1), 12 (2b; 1.89; 1–2), 14(1). Segment VI: hair 0(1), 1(6, 7b; 6.33; 6–8), 2(1), 3(4, 3b; 3.40; 2–5), 4(4, 5b; 4.75; 3–5), 5(5, 4b; 4.90; 4–6), 6(5, 6b; 5.30; 4–6), 7(1), 8(4b; 3.75; 2–5), 10(2b, 1; 1.74), 11(1), 12(2f; 1.75; 1–3), 14(1). Segment VII: hair 0(1), 1(6, 5b; 5.85; 5–7), 2(1), 3(7–8, 6b; 7.05; 5–9), 4(3b; 2.89; 1–4), 5(4, 5b; 4.40; 3–6), 6(4–5b; 4.50), 7(4, 3b; 3.80; 2–5), 8(5, 4b; 4.77), 10(3, 2b; 2.65), 11(1; 1.30; 1–2), 12(2b), 14(1). Segment VIII: 0(1), 5(3b; 3.11; 2–5), 7(6, 5b; 5.74; 5–7), 14(1); caudal margin of sternite distinctly emarginate in male, straight in female. Segment IX: hair 1(1, about 0.75 of segment length). Paddle as figured; very lightly pigmented, darker at extreme apex and at base; midrib strongly sclerotized, evanescent apically; external buttress distinct proximad; basal pigment bar indistinct; external margin with distinct short, heavy serrations in apical half; internal margin with minute submarginal spicules; hair 1 (1; slender). Male genital lobe extending to about 0.30 of paddle; pair of small ventral patches of weak spicules. Female genital lobe about the same length as segment X, extending to about 0.25 paddle; with large ventrocaudal patch of distinct spicules. Segment X: in the male indistinct, extending to 0.20 of paddle; in the female also indistinct, without visible cercal plates, extending to 0.25 of paddle.

Variation: When we first collected this population, we immediately noted the unusual shape of the pupal trumpet (fig. 6d), entirely unlike that figured for ***anhydor*** (Galindo, Blanton and Peyton, 1954: 123). As the shape of the trumpet is one of the most reliable diagnostic characters for the separation of mosquito pupae we were amazed to find that in the Saratoga Springs population it changed drastically when the pupae were reared from second instar larvae or earlier stages in the laboratory (fig. 6g, h). Upon study of our entire material, we find that there is some variation in the shape as well as the length under natural conditions (fig. 6d, e, f). Our rearing data indicate that the length and flaring of the trumpet is very markedly affected by the length of time that the preceding larval instars are maintained under artificial conditions. Differences can be noted even when the pupae are reared from young fourth instar larvae. The Saratoga Springs population shows considerable variability in the pupal chaetotaxy as is evident in the above description, which is based on a study of 10 skins from a single collection. We have examined 71 additional skins from two breeding sites for selected hairs. Statistically significant differences were noted for some of these hairs between the two breeding sites as well as between field-collected pupae and those obtained from early instar larvae reared in the laboratory. The latter generally had fewer branches in at least some hairs. We have combined all our data for these selected hairs in Table II to provide a basis for comparison with other populations.

EXPLANATION OF PLATE V

FIG. 6. Pupa of *Uranotaenia anhydor* Dyar. *a-h*, *U. a. anhydor* Dyar, Saratoga Springs population; *i*, *U. a. anhydor* Dyar, San Diego population; *j*, *U. a. syntheta* Dyar & Shannon, Luling, Texas. *a*, Ventral aspect of left anterior portion of cephalothorax; *b*, dorsal (left) and ventral (right) aspect of metanotum and abdomen of male pupa; *c*, detail of terminal portion of paddle; *d-j*, ventrolateral aspect of left trumpet.


a
b
c
d
e
f
g
h
i
j
0.5
0.25
I
II
III
IV
V
VI
VII
VIII
IX
X
PD

San Diego population (Fig. 6i)

Two pupal skins and one whole pupa from San Diego were examined. The same collection contains four third instar larval skins. It is quite possible that this material was reared under artificial conditions for a considerable period of time and therefore the characters may not be typical. Furthermore as noted below under bionomics the type of breeding site is quite different from the Saratoga Springs material. Nevertheless the difference in chaetotaxy is so marked that there is no difficulty in distinguishing the two populations in the pupal stage. The San Diego pupae appear to be distinctly larger and more heavily pigmented, have fewer branches in most hairs and a differently shaped trumpet.

Abdomen: 2.85 mm. Trumpet: 0.50 mm. Paddle: 0.67–0.72 mm.

Cephalothorax: Pigmentation stronger. Trumpet darker except for tracheoid which is much lighter; length and shape rather uniform in the three specimens (fig. 6i); gradually widened from about middle to apex; length about 5.2 median width; tracheoid about the same or less developed; pinna and slit in meatus similar. Hairs shorter and weaker, lightly pigmented; relative position similar. Hair 1(5b; 4.60; 3–5), 2(5b; 4.60; 3–5), 3(4, 5b; 4.40), 4(4b; 4.33; 4–5), 5(6b; 6.25; 6–7), 6(1), 7(4bf), 8(7–8b; 8.0; 7–10), 9(7b; 6.60; 5–8), 10(5b; 4.80; 4–5), 11(6b; 5.75; 4–7), 12(5, 6b; 5.20; 4–6).

Abdomen: Pigmentation darker throughout; integumentary ornamentation, rudimentary spiracles, and dorsal sensilla similar. Hairs shorter and weaker throughout, lightly pigmented; relative position similar. Segment I: hair 1(compound palmate, with about 65 terminal branches), 2(1), 3(2b), 4(6b; 6.33; 6–7), 5(6b), 6(3b; 2.75; 2–3), 7(3b; 2.67; 2–3), 10(3b; 2.67; 2–3). Segment II: hair 0(1), 1(9–10b; 9.20; 8–10), 2(3b), 3(7b; 7.25; 7–8), 4(1), 5(4–5b; 4.20), 6(3b; 2.67; 2–3), 7(1), 10(3b; 3.67; 3–5). Segment III: hair 0(1), 1(10b; 10.0; 9–11), 2(1), 3(9b; 8.50; 7–9), 4(3b; 3.25; 3–4), 5(5b; 4.80; 4–5), 6(3b; 3.33; 3–4), 7(1), 8(4–5b; 4.50), 10(4b), 11(1), 12(2bf), 14(1). Segment IV: hair 0(1), 1(6–7b; 6.80; 6–8), 2(1), 3(6–7b; 6.50), 4(2b; 2.20; 2–3), 5(6–7b; 6.20; 5–7), 6(4, 3b; 3.60), 7(1), 8(3b), 10(1), 11(1), 12(2b), 14(1). Segment V: hair 0(1), 1(5b; 5.20; 5–6), 2(1), 3(3b; 3.20; 3–4), 4(3b; 3.75; 3–5), 5(5b; 4.75; 4–5), 6(3b; 3.75; 3–5), 7(1), 8(3b; 3.33; 3–4), 10(4b; 4.33; 4–5), 11(1), 12(2b), 14(1). Segment VI: hair 0(1), 1(4b; 4.0; 3–5), 2(1), 3(3b), 4(4b; 3.67; 3–4), 5(4b; 4.20; 4–5), 6(4b; 3.75; 3–4), 7(1), 8(3b; 3.0; 2–4), 10(2b), 11(1), 12(1), 14(1). Segment VII: hair 0(1), 1(5b; 4.75; 4–5), 2(1), 3(5–6b; 5.50), 4(3–4b; 3.50), 5(4b; 3.25; 2–4), 6(4b; 4.50; 4–6), 7(3–4b; 3.50), 8(3-4b; 3.50), 10(2f), 11(1), 12(2f), 14(1). Segment VIII: hair 0(1), 5(3b; 3.0; 2–4), 7(3, 5b; 3.80; 3–5), 14(1). Segment IX: hair 1(1, length cannot be determined). Paddle similar; internal margin with stronger spicules; hair 1(1; lighter and weaker). Sexual differences apparently similar, structures in this area not clear.

Baja California population

Apparently only the male pupa was preserved by Brookman and Reeves. It is quite similar to the San Diego specimens and can be distinguished from the Saratoga Springs population on the basis of the same characters. The comparison in the description below is with the San Diego population.

Abdomen: 2.62 mm. Trumpet: 0.50 mm. Paddle: 0.72 mm.

Cephalothorax: Pigmentation similar. Trumpet almost identical. Hairs somewhat darker. Hair 1(3b), 2(5, 6b), 3(3, 4b), 4(6, 7b), 5(6b), 6(1), 7(4b), 8(9, 11b), 9(7, 8b), 10(6b), 11(6, 7b), 12(5b).

Abdomen: Pigmentation, ornamentation, rudimentary spiracles, and dorsal sensilla similar. Hairs somewhat darker and slightly better developed. Segment I: hair 1(50, 58d), 2(1), 3(2, 4b), 4(5b), 5(6, 7b), 6(2, 3b), 7(2, 3b), 10(3b). Segment II: hair 0(1), 1(8, 11b), 2(3, 4b), 3(9, 10b), 4(1), 5(4b), 6(3b), 7(1), 10(3, 4b). Segment III: hair 0(1), 1(13b), 2(1), 3(7, 11b), 4(3, 4b), 5(4b), 6(3, 4b), 7(1), 8(4b), 10(4, 5b), 11(1), 12(3b), 14(1). Segment IV: hair 0(1, 2b), 1(7, 9b), 2(1), 3(7b), 4(2, 3b), 5(6, 7b), 6(4, 5b), 7(1), 8(2b), 10(2, 3f), 11(1), 12(2, 3b), 14(1). Segment V: hair 0(1), 1(6b), 2(1), 3(3, 4b), 4(2, 5b), 5(5b), 6(5b), 7(1), 8(2, 3b), 10(4b), 11(1), 12(2b), 14(1). Segment VI: hair 0(1), 1(5b), 2(1), 3(3, 4b), 4(3, 4b), 5(4, 5b), 6(5b), 7(1), 8(2b), 10(1, 2f), 11(1), 12(1), 14(1). Segment VII: hair 0(1), 1(5b), 2(1), 3(5, 6b), 4(3, 4b), 5(3, 4b), 6(4, 5b), 7(2, 3b), 8(4b), 10(1, 2b), 11(1), 12(2b), 14(1). Segment VIII: hair 0(1), 5(3, 4b), 7(3, 4b), 14(1); caudal margin emarginate. Segment IX: hair 1(1, much weaker than in Saratoga Springs population, about 0.5 of segment length). Paddle similar; external margin with stronger spicules, some as well developed as teeth on external margin; basal pigment bar well developed; hair 1(1; similar). Male genital lobe extending to about 0.32 of paddle; ventral spicules small, arising from distinct imbrications. Segment X: indistinct, extending to about 0.22 of paddle; hair 1 present on both sides, with long stout basal portion widened apically and bearing about 6 slender branches (undoubtedly represents an anomaly, for this hair is normally developed only in *Toxorhynchites*).

Texas populations (Fig. 6j)

Nineteen whole pupae, collected in Palmetto State Park on Oct. 16, 1954, were examined but unfortunately many hairs are missing in the material and our sample for most hairs is less than

ten. However, there is no difficulty in separating this population in the pupal stage from the Saratoga Springs or other western populations. Except for the trumpet the similarity is much greater with the San Diego and Baja California specimens. The size and pigmentation are reminiscent of these populations. Many hairs have fewer branches than we have seen elsewhere in the complex while others are intermediate and a few show even more branches than the Saratoga Springs population. The trumpet is long and slender as in the typical Saratoga Springs specimens but it lacks the strong flaring of the apex. The comparison below is with the Saratoga Springs population.

Abdomen: 2.75 mm. Trumpet: 0.50 mm. Paddle: 0.65 mm.

TABLE II

BRANCHING OF SELECTED PUPAL HAIRS
SARATOGA SPRINGS POPULATION
(162 hairs)

HAIR	MODE*	RANGE	MEAN	SD	SE
3-C	6, 7, 5	5–8	6.08	0.76	0.06
4-C	7, 8, 6	4–10	7.01	1.15	.09
5-C	7, 8, 6, 9	5–10	7.42	1.08	.09
8-C	9, 10, 8	7–12	9.29	.91	.07
9-C	9, 8, 10	5–13	8.79	1.06	.08
12-C	7, 8, 6	5–10	7.28	1.09	.09
3-I	4, 3	1–6	3.46	.62	.05
10-I	4, 3	3–5	3.86	.45	04
1-II	10–14	4–18	11.73	1.84	.15
3-II	9, 8, 10	6–12	8.74	.88	.07
1-III	10-14	5–16	12.08	1.92	.15
3-III	10, 9, 11	7–13	9.66	1.17	.09
6-III	5, 4	3–6	4.89	.60	.05
1-IV	8, 9, 7	5–11	8.29	1.15	.09
4-IV	8, 7, 9	5–11	7.69	.97	.08
6-IV	5, 6, 4	3–7	5.00	.58	.05
1-V	7, 6	4–8	6.50	.82	.07
4-V	7, 5, 6	4–9	6.16	1.01	.08
5-V	5, 4	3–7	4.79	.95	.08
6-V	5, 6	4–7	5.09	.59	.05
1-VI	6, 5, 7	4–8	6.03	.82	.07
6-VI	5, 4	3–6	4.91	.64	.05
1-VII	5, 6	3–7	5.33	.84	.07
3-VII	6, 7, 8	5 9	6.55	1.02	.08
7-VIII	5, 6, 7	3–7	5.45	.43	.03

*Usual number of branches, in order of frequency, representing 75% or more of total.

Cephalothorax: Pigmentation stronger. Trumpet darker except for tracheoid which is somewhat lighter; length and shape rather uniform in all 19 specimens, as figured (fig. 6j); gradually but only slightly widened to apex from slightly beyond middle; length about 8–8.2 median width; tracheoid, pinna and slit about the same. Hairs shorter, weaker, lightly pigmented; relative position similar. Hair 1(3, 2–4b; 3.00), 2(3, 4b; 3.73; 3–5), 3(4, 5b; 4.44), 4(5–7b; 6.00), 5(6, 5–7b; 6.25), 6(1; 1.06; 1–2), 7(4bf; 3.89; 3–4), 8(4–8b; 6.00), 9(5b), 10(4b; 4.83; 4–7), 11(4b; 4.46; 4–6), 12(4, 5–6b; 4.56; 3–6).

Abdomen: Pigmentation somewhat stronger; integumentary ornamentation, rudimentary spiracles and dorsal sensilla similar. Hairs shorter and weaker throughout, lightly pigmented; relative position similar. Segment I: hair 1 (compound palmate, with 50–60 terminal branches), 2(1), 3(3b; 3.19; 3–4), 4(6, 5b; 5.56; 4–7), 5(6, 5b; 5.77; 4–7), 6(4, 6b; 4.80; 4–6), 7(3, 2b; 2.79; 2–4), 10(3–4b; 3.50). Segment II: hair 0(1; 1.15; 1–2), 1(7–12b; 9.50), 2(3, 4b; 3.25; 2–4), 3(5–8b; 6.50), 4(1), 5(5, 3–4b; 4.62; 3–6), 6(3–4b; 3.50), 7(1), 10(3, 2, 4b; 2.89). Segment III: hair 0(1, 2b; 1.37; 1–3), 1(8–5–7–12b; 8.00), 2(1), 3(8, 9b; 8.12; 5–10), 4(4, 3b; 3.67; 2–5), 5(4, 3b; 3.25), 6(5, 4b; 4.43; 3–5), 7(1), 8(5, 4b; 4.93; 3–7), 10(4–5b; 4.80; 4–6), 11(1), 12(2bf; 2.07; 1–3), 14(1). Segment IV: hair 0(1, 2b; 1.33), 1(5–6–8b; 6.33), 2(1), 3(6, 5b; 5.83; 4–8), 4(2b; 2.12; 2–3), 5(5–8b; 6.50), 6(3, 5b; 4.43; 3–7), 7(1), 8(3, 4b; 3.27), 10(2bf; 2.06; 2–3), 11(1), 12(2b; 2.10; 1–3), 14(1). Segment V: hair 0(1, 2b; 1.30), 1(6, 5–7b; 6.00), 2(1), 3(3b), 4(5–6b; 4.60), 5(5, 4b; 5.50), 6(5, 4, 6b; 5.00), 7(1), 8(3, 2b; 2.71; 2–4), 10(4, 3b; 3.64; 2–5), 11(1), 12(2b, 1; 1.20), 14(1). Segment VI: hair 0(1; 1.11; 1–2), 1(4b; 4.25; 4–5), 2(1), 3(2, 3b; 2.33), 4(2, 3b; 2.62; 2–4), 5(4, 3b; 3.67), 6(4–5b; 4.50), 7(1), 8(3, 5b; 2.87; 2–4), 10(2b), 11(1), 12(1), 14(1). Segment VII: hair 0(1; 1.12; 1–2), 1(4–5b; 4.50), 2(1), 3(3–5–6b; 4.67), 4(3b; 2.75; 2–3), 5(4–5b; 4.50), 6(4, 3–5b; 4.00), 7(3, 4b; 2.92; 1–4), 8(5, 4b; 4.78; 4–6), 10(2b), 11(1), 12(2b, 1: 1.57), 14(1). Segment VIII: hair 0(1), 5(3b; 2.80; 2–3), 7(4, 5b; 4.33), 14(1; 1.21; 1–2). Segment IX: hair 1(1; about 0.5–0.6 of segment length; one hair duplicated in one specimen). Paddle similar; external and internal margins with serrations stronger and more distinct; hair 1(1; lighter and weaker). Sexual differences similar.

BIONOMICS

1. *Saratoga Springs Population*

Saratoga Springs (Fig. 7)

Saratoga Springs lies in N. W. ¼ sec. 2, T.18 N., R. 5 E., San Bernardino County, California, at an elevation of approximately 215 feet above sea level, a few feet above the level and about half a mile north of the main flood channel of the Amargosa River. This area is included in the southeast portion of Death Valley National Monument. Saratoga Springs comprises some 50 acres of seepages, springs, open permanent lakes and adjacent land nestled in a cove on the west side and at the southern extremity of the western spur of the Ibex Mountains (fig. 7a). A low, rocky hill at the end of a western extension of the spur bounds the area to the south. The entire area gives the impression of being on a ledge elevated slightly over the surrounding country to the west. At the southwest corner it is from one to three feet above the sparse salt meadow of the lower Amargosa. Beginning about 100 feet

north of the main spring a distinct sandy ridge (probably an artificial dike) forms the western boundary. The ridge expands into sand dunes which curve irregularly to form the northern boundary leading to another westerly extension of the mountain spur. The dunes reach a height of about 15 feet at their westernmost extension. As a result of these features, Saratoga Springs is hidden from view from almost every aspect. It is generally stated that there are four principal springs (Thompson, 1929: 587). The two springs which are usually visited are at the extreme southwest corner of the area only some 30 feet apart (fig. 7g). The more easterly is enclosed in a spring house and is used for drinking. Its outflow empties into the main spring pool to the west. This pool is about 32 feet in diameter and from 4 to over 5 feet in depth. The outflow from this spring, through a shallow channel to the north, is joined about 250 feet northward by a channel from the small open spring, which is located some 250 feet east of the main spring. The combined channel, hidden by vegetation, widens and empties some 500 feet north of the main spring into a large open pond, about 145 feet long and 35 feet wide, and up to 3 feet deep. This pool is hidden from view from the west by a very dense growth of *Scirpus olneyi*, reaching a height of 8 feet or more. Leading northeastward from this pond is an irregular shallow channel which eventually empties into the southeast lake. From the small spring an east branch of the outflow channel supplies the east lake. Finally the fourth spring, some 800 feet northeast of the main spring, drains directly into the east lake. The lakes comprise some 10 to 15 acres of open water. Their appearance suggests that they were dredged out. At low water three distinct interconnected lakes are seen separated by shallow bars; to the east is the largest lake, to the west there is a small northwest lake and a larger southwest lake. At high water all the lakes merge into one and extend into large beds of *Scirpus* to the south, apparently reaching the large pond. It has been generally assumed that the lakes are fed chiefly by the main spring and adjacent springs at the southwest corner. It appears to us, however, that the output of these springs is only a few gallons a minute and that the main supply comes from seepages in the lakes themselves and the immediately surrounding areas to the south. At every one of our visits to Saratoga Springs in 1954, except in October, there was no flow in the channel from the main spring nor from the other springs, yet the lakes, although considerably lower in September, were far from dry and were supporting millions of fish. It appears to us that the large pond is essentially a spring, possibly with a much higher output than the so-called main spring, and that it supplies the western lakes. In the stand of *Scirpus* at the south end of the eastern lake there is some deep water and it would seem that there are seepage springs in this area also. The water level in the area fluctuates probably at least two feet during the season. In October, 1954 it had risen about a foot above the level in September and had not yet reached the level in June.

The air temperature at Saratoga Springs has been between 115° and 122° F. in the shade for the greater part of the day on our trips in June, July and September. In October it was still between 100° and 105° during the middle of the day. At night the temperature seldom dropped below 80° F. except in October, when it stayed at about 70° F. However, during the summer of 1954 there were two periods of considerably lower temperatures. In the general area the winter night temperatures probably fall below freezing, at least during December and January. The humidity was not measured but it is undoubtedly extremely low, except near water and in stands of vegetation in the water. The annual rainfall is probably no more than at Furnace Creek where it has averaged less than 1.50 inches in over 30 years.

The water from the main spring as well as from the lakes has been analyzed several times. The main spring water contains 3,041–3,098 p.p.m. total solids; 994 p.p.m. Na+K, 1,039 p.p.m. SO_4, 657 p.p.m. Cl, and has a pH of 8.2. The lake water contains 5,394 p.p.m. total solids with approximately the same proportions of salts and has a pH of 8.6. The temperature of the main spring is very uniform, usually between 82° and 83° F., with extremes of 80° and 85° F. recorded (Mendenhall, 1909: 47). The water temperature in the stands of *Scirpus* surrounding the large pond varies greatly as indicated below and in the shallow lakes there is probably even more fluctuation.

The aquatic and semiaquatic vegetation of Saratoga Springs has not been studied in detail but the following conspicuous forms have been identified for us by Dr. Mildred E. Mathias and Dr. Henry J. Thompson: *Chara* sp., *Ruppia maritima* L., *Distichlis spicata* (L.) Greene, *Phragmites communis* Trin., *Scirpus paludosus* Nelson, *S.*

EXPLANATION OF PLATE VI

FIG. 7. Saratoga Springs, California (photos by W. A. McDonald). *a*, Panoramic view looking northwest into Death Valley; 1, southwest corner in vicinity of main spring; 2, large pond; 3, northwest camping ground; 4, southwest lake; 5, east lake. *b*, Stand of *Scirpus olneyi* south of southwest lake, looking northeast; breeding site of *U. anhydor* in June, 1954. *c*, View north from hill south of main spring; large pond at arrow. *d*, General view of large pond; stands of *Scirpus olneyi* bordering the open water. *e*, View across large pond to breeding site of *U. anhydor* in July, Sept. and Oct. 1954. *f*, Close-up of breeding site of *U. anhydor* on east bank of large pond; collector on opened, trampled mat of *Scirpus olneyi* over about one foot of water and muck. *g*, Southwest corner of area with main spring pool at arrow on the left, spring house at arrow on the right.

c

d

b

f

g

olneyi Gray, *Juncus cooperi* Engelm., *Anemopsis californica* (Nutt.) Hook., *Nitrophila occidentalis* (Moq.) Wats., *Allenrolfea occidentalis* (Wats.) Ktze., *Ceratophyllum demersum* L., *Pluchea sericea* (Nutt.) Cov. Representative specimens have been deposited in the U.C.L.A. Herbarium. We have not been able to find any *Scirpus americanus* or *Typha* sp. reported by Miller (1948: 27).

Saratoga Springs is of great zoological interest, not only because it is an oasis in one of the hottest and driest areas in the world, but because it forms one of the largest refuges for descendants of aquatic and semiaquatic animals which were abundant in the area at the time of the pleistocene Lake Manly (Hubbs and Miller, 1948). One of these relict forms is the fish *Cyprinodon nevadensis* Eigenmann and Eigenmann, 1889. Its nominate subspecies is restricted to Saratoga Springs, where it is found in the main spring, the large pool and literally in millions in the lakes. Six additional subspecies and several races are restricted to individual springs in the Death Valley system in California and Nevada (Miller, 1948). Among the insects the tabanid, *Chrysops latifrons* Brennan, 1935, is apparently restricted to the Amargosa drainage and has one of its largest isolated populations at Saratoga Springs. Little entomological collecting, particularly in the summer time, has been done at Saratoga Springs but we have found several interesting forms, some of which are undoubtedly relict populations.

Adults

Adults of this population were first collected at 7:45 p.m. (P.S.T.) on June 16, 1954 at the main spring by the light of Coleman lanterns. We have collected numerous specimens at Coleman lanterns since then at the same place and also near the southwest lake, the northwest camping ground and the margins of the large pond. The adults are evidently very sensitive to temperature and humidity. We have collected them in greatest numbers near water and when the air temperature was 85° F. or less. This may account for our failure to collect them at lights during the seasons of 1952 and 1953 when the night temperatures were between 95° and 105° F. at the time of collecting. The females apparently move as much as 100 yards, perhaps more, from their diurnal resting places but the males remain closer to the stands of *Scirpus* and *Phragmites*. On the June trip we did not collect near the breeding sites and obtained largely gravid females. On the October trip our collecting was done at the breeding sites and the immediate vicinity and we obtained almost three times as many males as females; only a few of the latter were gravid. The density of the adult population increased progressively from June to October; on the October trip over 400 specimens were collected between 6:00 and 7:15 p.m. (air temperature 75°–71° F). Apparently the adults are active through most of the night and return to diurnal shelters early in the morning; we collected them as late as 1:30 a.m., but not at 5:00 a.m. on July 27.

During the day the adults undoubtedly rest in the stands of *Scirpus* and *Phragmites* in the vicinity of the breeding sites. It is very difficult to locate them in such situations but we have seen two specimens and have noted that by disturbing these stands when collecting at night the catch can be greatly increased. The daytime air temperature in the stands of *Scirpus* probably does not go much over 85° F. and the humidity is very high. On Oct. 17, with the outside air temperature 75° F. at 7:30 a.m. we found the temperature in the *Scirpus* stands to be 60° F.

Although we have collected many gravid females in various stages of development we have never seen a blooded one. It is possible that this species does not take a blood meal, as is apparently the case with many other *Uranotaenia*. However, ample blood supply is available in the area, particularly from *Hyla regilla* Baird and Girard. We have succeeded in obtaining oviposition from confined gravid females in the field and from some transported to Los Angeles. A wet towel around the glass jar provided sufficient cooling and humidity for these delicate insects to withstand a trip of five hours with the air temperature above 100° F. A marked change in the sex ratio of adults collected at lights as well as those reared from pupae collected at random in the field was noted during the season. In the June and July collections there were about four times as many females as males, in the September collections the sexes were evenly distributed, while in October, there were almost three times as many males as females. This situation may be due entirely to the well-known difference in the rate of development of the sexes in the immature stages.

During the season of 1954 the *Uranotaenia* was the most abundant mosquito attracted to lights at Saratoga Springs. We also collected *Anopheles franciscanus* McCracken, 1904, *A. freeborni* Aitken, 1939, *Culiseta inornata* (Williston, 1893), *Aedes nigromaculis* (Ludlow, 1907), *Culex erythrothorax* Dyar, 1907, *C. tarsalis* Coquillett, 1896 and *Corethrella laneana* Vargas, 1946.

Immature stages

The breeding sites of this population were located after many fruitless hours of dipping the main spring, the margins of the lakes and mats of *Ruppia maritima*. Although many *Culex tarsalis* and *Anopheles franciscanus* larvae and pupae were located in these situations, only a single *Uranotaenia* pupa was found on June 17, 1954 at the base of a clump of *Scirpus olneyi* at the southwest corner of the southwest lake.

Deep in a low stand of *Scirpus* (fig. 7b) in small isolated or interconnected pockets of water we finally discovered many egg rafts and young larvae and a smaller number of fourth instar larvae and a few pupae. These water pockets were between clumps of *Scirpus* and were covered over with previous years' growth of rushes so dense that the water was in almost total darkness. Furthermore the immature stages were chiefly in the heart of the clumps and not in the open water.

In July this site had dried out but we located a more prolific breeding place in the much taller and denser stand of *Scirpus* on the east bank of the large pond (fig. 7c, d). The accumulation of previous years' growth of *Scirpus* is so dense here that one can walk on this mat without realizing the presence of water from a few inches to two feet or more below it. It is under this mat that the *Uranotaenia* immature stages are found. To collect them the mat is trampled down to the water surface and partially opened up (fig. 7e, f). The water and muck below the mats is from a few inches to two feet or more in depth. Here again the immature stages are in almost total darkness and are protected from even the smallest fish which cannot penetrate into the dense mats.

Undoubtedly the *Urantaenia* will be found breeding in *Scirpus* mats elsewhere at Saratoga Springs but the large pond provides probably the best and least disturbed permanent habitat since the water level fluctuates relatively little here. At higher water the stands of *Phragmites* and other dense vegetation may also serve as breeding sites.

The water temperature is much lower in the *Scirpus* mats than in the open and fluctuates much less than in the open pond and lakes. In the large pond it was 80° F. at 4:00 p.m. on July 28, 70° F. at 1:30 p.m. on Sept. 11, and between 58° and 60° F. at 8:00 a.m. on Oct. 17, 1954. In both breeding sites the water is brown and has a strong sulfurous odor. It is clear when undisturbed but when dipped a fine flocculent muck is distributed through it only to settle in a short time.

The larvae, particularly the fourth instar, are very easily disturbed and will remain hidden in the muck for a long time. They have the usual *Uranotaenia* attitude at the surface and are rather conspicuous with their black heads strongly contrasting with the white bodies. Their movements are sudden and very quick. The small pupae are extremely active and are more difficult to find.

The intensity of the breeding increased greatly during the season. In June we were able to find less than 100 fourth instar larvae in about 10 man-hours of dipping in an area of more than 100 square feet. In September on the other hand we collected well over 2000 fourth instar larvae in an area less than 10 square feet in about 5 man-hours. In October the breeding did not appear to be as dense in any one area, but it was probably much more widespread as the result of a rise in water level. On every inspection egg rafts, all larval instars, and pupae were found. In all probability the breeding is greatly reduced and may stop completely during December and January, but there was little indication of a falling off in October.

The larvae are very sensitive to high temperatures and are easily injured in transporting in the field as well as in a car. Survival is increased by individual isolations in vials cooled by evaporation. The fourth instar larvae are particularly delicate, especially when ready to pupate. Pupae on the other hand are very hardy.

No information was obtained on the length of the life cycle in nature, but in the laboratory it took about two weeks to obtain mature fourth instar larvae from eggs and two days for pupation.

The most interesting mosquito found breeding in association with *Uranotaenia* at Saratoga Springs is *Corethrella laneana* Vargas, 1946, a species formerly known by a single male from Monterey, Nueva Leon, Mexico (Belkin and McDonald, 1955). In addition a few specimens of *Culex erythrothorax* Dyar, 1907 and *C. tarsalis* Coquillett, 1896 were found in the *Scirpus* stands.

2. *Other Populations*

Little is known about the adults of other populations of the complex except that both males and females may be attracted to artificial lights. C. B. and R. N. Philip (C. B. Philip, 1954 *in lit.*) collected a small series of females "on a sheet hung behind a gas light in the evening" at Fairbanks Springs, Nevada on August 21, 1949. On a trip later in the season C. B. Philip tried to get males but did not find even females. C. S. Richards (1954, *in lit.*) collected about eight females in light traps from July to October at St. David, Arizona. All the records from New Mexico (Ferguson and McNeel, 1954), Oklahoma (Griffith, 1952), and the majority of records from Texas (McGregor and Eads, 1943; Randolph and O'Neill, 1944; Porter, 1946; Rueger and Druce, 1950; Eads, Menzies and Ogden, 1951) are based on light trap catches made usually between May and October. Dampf (1943: 147–160) presented a great deal of data on light trap collections in the Federal District of Mexico and came to the conclusion that *syntheta* is apparently a winter species, most abundant in November and with scanty spring and summer generations. Freeborn (1926: 350) reports seeing a single female taken at Camp Kearney "in a large packing box placed near a fresh water creek for the purpose of affording a collection point in the otherwise barren terrain." Adults of other populations have not been collected in nature or are without data.

Brief notes on breeding sites are available for the Bonsall, San Diego, Baja California, Arizona and three Texas populations. In most of these cases the immature stages have been collected in open situations in contrast to the Saratoga Springs breeding sites. Dyar (1907: 128) collected a single larva in a temporary swamp full of reeds and later (Howard, Dyar and Knab, 1917, 4: 1042) rediscovered the larvae in the fringe of cat-tails and *Lemna* in a pond near the mouth of the San Diego River in early May. The larvae collected by Seaman and Richards at Bonsall (Seaman, 1945) on Sept. 15, 1944 were found in "grass-tule marsh" in the San Luis Rey River bed. Brookman and Reeves (1953: 226) collected two pupae on June 13, 1948 in Baja California "at the edge of a tule patch as well as in the mat of algae and *Lemna*" in a small pond formed by a sand bar at the ocean outlet of a small stream. C. S. Richards (1954, *in lit.*) found one pupa (skin lost) and later, on Oct. 22, 1953, one larva in a "small, grassy, roadside ditch, receiving water as seepage and overflow from an artesian well reservoir" at St. David, Arizona. Porter (1946: 535) collected on July 12, 1944 at Meecham Field, Texas a single larva "from still areas along the margins of a shallow, grass-clogged, flowing ditch. . . . Most of the ditch is exposed to bright sunshine throughout the day and no part is heavily shaded. The water is cool and clear, the source, a spring, being approximately 25 yards from where the larva was taken." E. S. Ross (1954, *in lit.*) collected all stages except eggs from July 6 to Oct. 30, 1942 at Fort Sam Houston, Texas "on the semi-shaded side of Salado Creek where it flows through the post. Larvae were found only in ruts, puddles and hoofprints in spring seepages on a slope near the creek, but never in it." The largest collections of immature stages of *syntheta* have been made by O. P. Breland from Aprll through October in Palmetto State Park, some eight miles south of Luling, Texas. He found all the larval instars exclusively in small depressions along a stream that contained masses of water hyacinths (Breland 1948: 108–109). None of the other numerous mosquito breeding sites in this area were utilized by *syntheta*.

SYNOPSIS OF THE ANHYDOR COMPLEX

The chief characteristics of the various components of the *anhydor complex* as here understood may be summarized as follows:

1. *Male and female:* wing 2.2–2.9 mm.; prescutal streak of bluish scales always well developed, narrow, consisting usually of one row of scales, usually with few or no dark scales bordering it mesally, extending from transverse suture at scutal angle to anterior dorsocentrals; supraalar streak of bluish scales in line with prescutal streak, extending to transverse suture, scales broad anteriorly, elongated toward wing root, surrounding area with few or no narrow bronzy scales; narrow scales of mesonotum dark bronzy, short and sparse; *stp* with a narrow upper streak of bluish scales; knee spots and tibial spots conspicuous, pure white; abdominal tergal spots usually well developed, pure white. *Pupa:* trumpet narrow and elongate, gradually and slightly flared to apex, index about 8.0; hairs poorly pigmented and often with fewer branches than in other populations; hair, 1, 2-C (usually 3, 4b), 9–C (usually 5b), 6-I (usually 4–6b), 3-II (usually 5–8b), 1-III (usually 5–8b), 7–VIII (usually 4–5b). *Fourth instar larva:* head capsule pigmentation intermediate; pigmentation of siphon, comb plate and anal saddle strongest; hairs usually intermediate in number of branches; hair 2–I (usually 3–5b), 5–VIII (usually 7, 8b). *Larval habitat:* open or semi-shaded situations, small depressions with vegetation along streams and near spring seepages, also margins of small streams.

East of Continental Divide—U. *anhydor syntheta*.

2. *Male and female:* wing 2.0–2.6 mm.; prescutal streak of bluish scales always well-developed, broad, consisting of several rows of scales, usually with few or no dark scales bordering it mesally, extending from a considerable distance cephalad of scutal angle to level of humeral bristles; supraalar streak of bluish scales not in line with prescutal streak, not reaching the transverse suture, scales broad anteriorly, elongated toward wing root, surrounding area with few or no narrow bronzy scales; narrow scales of mesonotum dark bronzy, short and sparse; *stp* with a broad upper patch of bluish scales; knee spots moderately well developed, dingy white; tibial spots poorly developed; abdominal tergal spots inconspicuous, dingy white. *Pupa:* trumpet narrow and elongate, usually abruptly and strongly flared at apex, index usually 10.0 or more; hairs well pigmented and usually with more branches than in other populations; hair 1, 2–C (usually 6, 5b), 9–C (usually 10, 9b), 6–I (usually 3, 4b), 3–II (8–10b), 1–III (10–14b), 7–VIII (usually 5–7b). *Fourth instar larva:* head capsule pigmentation extremely dark; pigmentation of siphon, comb plate and anal saddle weakest in complex; hairs usually with more branches than in other populations; hair 2–I (usually 1–3b), 5–VIII (usually 8–10b). *Larval habitat:* in almost total darkness in beds of *Scirpus olneyi* surrounding springs or seepages.

Amargosa drainage, Death Valley System; Saratoga Springs and probably Fairbanks Springs—*U. a. anhydor*, Saratoga Springs population.

3. *Female:* wing 2.6–2.8 mm.; prescutal streak of bluish scales variable, rarely approaching preceding, usually greatly reduced, sometimes completely absent, many narrow light coppery scales bordering mesally or replacing the streak; supraalar streak of bluish scales as in preceding but scales narrower, often greatly reduced in extent, and sometimes partially replaced by coppery

scales, surrounding area with many narrow coppery scales; narrow scales of mesonotum coppery, long and very dense, particularly caudad; *stp* as in preceding; knee, tibial and tergal abdominal light spots less developed and darker than in the preceding. *Male:* similar to female except that prescutal streak is always distinct and consists of at least two rows of scales and the supra-alar streak is better developed. *Pupa:* trumpet broader than in other populations, gradually and slightly flared to apex, index less than 6.0; hairs poorly pigmented and often with branches intermediate in number; hair 1, 2–C (usually 5b), 9–C (usually 7b), 6–I (usually 3b), 3–II (usually 7b), 1–III (usually 10b), 7–VIII (usually 3–5b). *Fourth instar larva:* head capsule pigmentation lighter than in other populations; pigmentation of siphon, comb plate and anal saddle intermediate; hairs usually with smallest number of branches; hair 2–I (usually 2b), 5–VIII (usually 7–10b). *Larval habitat:* open situations, permanent or intermittent pools, in fringe of cat-tails, tules, in mats of algae and *Lemna* and grassy seepage ditches.

West of Continental Divide; San Diego Co., Calif.; Baja California, Mexico; and Cochise Co., Ariz.—*U. a. anhydor.*

DISCUSSION

The populations of *U. anhydor* and *U. syntheta* we have examined are so close morphologically in all known stages that we believe this complex consists of a single polytypic species, *U. anhydor*, which is so distinct from all other American *Uranotaenia* that it deserves the rank of a separate series given to it by Galindo, Blanton and Peyton (1954: 112), although some of the characters mentioned by these authors do not hold. The *anhydor* series (or subsection in the nomenclature of Belkin, 1953a: 316) may be characterized as follows: *Adults:* head with narrow orbital line of bluish scales expanded laterally toward *apn*, erect vertical scales very numerous; mesonotum with supra-alar and prescutal lines of bluish scales, sometimes both reduced; *apn* with bluish scales; *ppn* with a few narrow dark scales dorsally; *stp* with longitudinal streak of bluish scales in upper part and a vertical streak of bluish scales in lower posterior part; *ume* with a patch of about eight light bristles; fore coxa with a small patch of bluish or whitish scales; light femoral knee spots well marked or reduced; tibiae, particularly hind and fore, with apical light scales; tarsi entirely dark; vein R_2 about 0.75–0.80 of R_{2+3}; base of vein R with light scales on anterior margin; "microtrichia" unusually large for genus; abdomen with conspicuous or reduced basal lateral light spots. *Male genitalia:* unique type in American species; tergal arms of lateral plates straight rods fused mesally to form a long narrow dorsal bridge; paraproct with distinct lateral sclerotizations. *Larva:* valve hair 13 not developed into a long hair with twisted base; head hairs 5 and 6 not spikelike, usually 2, 3b. *Pupa:* impossible to characterize because most American species are undescribed; pinna and slit in meatus of trumpet unusually short.

The known geographic range of *U. anhydor*, as here understood, includes a vast arid area from the Gulf of Mexico to the Pacific Ocean, from eastern Texas and central Oklahoma, New Mexico, Arizona, southwestern Nevada and southeastern California in the north to Mexico City in the south. Future collecting may extend the range in the north to southwestern Kansas and southern Colorado and Utah, and possibly to the south in Mexico.

The populations in the United States east of the Continental Divide are distinguished from those to the west largely on the basis of ornamentation of the adults. They constitute, in our opinion, the subspecies *U. anhydor syntheta*, which appears to be remarkably uniform throughout its range. We have not seen material from eastern or central Mexico but it appears that the populations in that area are to be referred to *syntheta* as has been done by Dampf (1943).

West of the Continental Divide the situation is much more complex and unfortunately, except for the population at Saratoga Springs, the material is very scanty. For this reason we prefer for the present to include all these populations under the nominate subspecies. However, we believe that the Saratoga Springs population together with the other populations in the Amargosa drainage will prove to be subspecifically distinct from the other western populations. In the material now at hand, the San Diego, Baja California and Arizona populations appear to be very similar morphologically and can be distinguished from the Saratoga Springs population in the female, pupa and fourth instar larva, whenever these stages are known. The plasticity of the Saratoga Springs population, its marked morphological response to unusual environmental conditions, such as rearing in the laboratory, its entirely different type of habitat, and the fact that we have found a number of instances of local ecological races well marked by morphological differences in other mosquitoes in California, suggest caution in interpreting this population as a distinct subspecies at this time. The variability of the other western populations, even with the scant material at hand, indicates a great plasticity in this complex and a strong direct response to environmental conditions in the expression of morphological characters.

Whatever its taxonomic status may prove to be, the Saratoga Springs population is of great interest for it very likely represents a relict population isolated in the Death Valley System from late Pleistocene times. From our observations on the behavior of the adults it appears unlikely that they are capable of long flights and

survival under extreme arid conditions. It is possible that some dispersal may take place in the winter months, particularly if this population reaches at that time a peak of abundance such as Dampf (1943) reports for *syntheta* in Mexico. However, at the present time there are apparently no suitable breeding sites for *Uranotaenia* for at least 50 miles outside of the Amargosa drainage. Within the Amargosa drainage itself this population has probably been isolated for a considerable length of time. There appear to be no *Uranotaenia* or no suitable breeding sites for this species at any of the springs within a radius of 12 miles, while other species, particularly *Culex tarsalis* and *Anopheles franciscanus*, occur commonly in such situations. Probably the nearest suitable permanent breeding sites for *Uranotaenia* at present are to be found near Tecopa, about 16 miles over mountain ranges and about 22 miles by way of the Amargosa River bed. Unfortunately we have made no collections at Tecopa.

The Saratoga Springs populations cannot be said to be intermediate between *syntheta* and the typical *anhydor*. While the light thoracic ornamentation is better developed than in other western populations, it represents merely an intensification of the condition found in typical *anhydor* and not a transition to *syntheta*. The larval characters show the extreme development within the complex in the dark pigmentation of the head capsule and in the number of branches of some hairs, while in other hairs the number of branches is intermediate or even the lowest for the complex. Probably the most obvious characteristic of this population is in the shape of the pupal trumpet. We have shown that this is somewhat variable and is apparently modified under laboratory conditions. Unfortunately, it is not known how constant this character is in other populations.

The great variability in most characters that we find in the Saratoga Springs population may be due to the plasticity that such a population must have maintained in the past and must still preserve to survive in an environment subject to extreme fluctuation. We find a similar great variability in *Chrysops latifrons* Brennan, another relict form endemic to the Amargosa drainage. It appears to us that the season of 1954 was particularly favorable to the breeding of *Uranotaenia* and that such densities are not often reached by this population. Some of the problems of population structure and population genetics could very advantageously be studied in nature with relict forms isolated in biological islands such as we find at Saratoga Springs.

It is obvious that taxonomic studies on the population level are much needed in mosquitoes. In the past even subspecies have been used very seldom in this family. It is evident however that local populations or races characterized by distinct morphological features are of common occurrence. Failure to recognize this situation has led some workers on the one hand to question the reliability of so-called species characters and on the other to report polytopic subspecies. Physiological differences between such races undoubtedly exist and would account for the differences in such behavior as food preference and susceptibility to insecticides. Isolated populations of species that are aquatic or semi-aquatic in one or more stages are particularly conspicuous and well characterized in the arid portions of the southwestern United States. It seems probable that many of these populations are intermixed from time to time during occasional periods of high rainfall. However, a few of these, such as the Saratoga Springs population of *U. anhydor*, undoubtedly remain isolated and evolve into distinct forms. We believe that good characters for the separation of related populations of mosquitoes will be found in the larval and pupal chaetotaxy. It will be noted in Table I that statistically significant differences exist in the case of several hairs for the Saratoga Springs and the Texas populations. The C.D. (coefficient of difference) for hair 2–I in the two populations is 1.24, indicating a separation of about 89% which is near the conventional level of subspecific difference. However, from a practical standpoint of identification this character is not satisfactory. None of the other hairs approach 2-I in the magnitude of the C.D. One solution would be to use a combination of hairs to obtain a multiple character index such as is used by ichthyologists for more clearcut separation of the various populations. Unfortunately our samples of the populations outside of Saratoga Springs are inadequate for this purpose and we confine ourselves to a presentation of the data from the latter population only. We must stress that blind reliance should not be placed on hair branching as a taxonomic character for, as with all other characters, the expression of the chaetotaxy is greatly influenced by the environment. Our hesitancy in recognizing the Saratoga Springs population as a subspecies is due to a large extent to ignorance of the possible direct environmental modifications in the material at hand.

Little attention has been paid in the past to the larval instars of culicine mosquitoes, particularly in North America. A knowledge of these would be of considerable value in taxonomic, phylogenetic and chaetotaxic studies. We have taken advantage of the abundant material of the Saratoga Springs population of *anhydor* to study these in some detail, particularly in regard to the chaetotaxy. The striking diagnostic characters of the four instars may be summarized as follows: *First instar:* egg tooth present; anal saddle incomplete; ventral brush completely absent; siphon unsclerotized in basal fourth or more; collar absent but "ocular plate" with distinct caudolateral projection dorsally; hairs 7–P,

8–M, 7–T, 9, 13–I–VII, 8–S, 4–X absent, all others present, spiracular rudiments and dorsal sensilla apparently not developed; comb plate restricted to base of scales; comb scales fringed laterally and apically; acus composed of two small separate plates on each side not joined to sclerotized part of siphon; pecten teeth broad, fringed apically and laterally, several present on unsclerotized part of siphon. *Second instar:* egg tooth absent; anal saddle incomplete; ventral brush composed of 2 pairs of hairs; siphon unsclerotized at most in basal tenth; collar completely absent and no caudolateral projection from ocular plate; hairs 8-M, 7-T, 9–I–VII absent, all others present; comb plate as in first instar; comb scales fringed laterally only; acus plates of each side united and joined to sclerotized part of siphon; pecten teeth narrower, with more distinct apical fringe, usually all on sclerotized part of siphon; spiracular rudiments present; dorsal sensilla absent. *Third instar:* as in second except for the following: ventral brush composed of 4 pairs of hairs; all hairs present; dorsal sensilla present. *Fourth instar:* as in the third instar except for the following: anal saddle completely ringing segment; ventral brush composed of 5 pairs of hairs; comb plate large, not restricted to base of scales, including hair 0.

It was of interest to find two morphological anomalies in our material. One of the 471 females from Saratoga Springs showed two lines of broad appressed whitish scales on the posterior part of the mesonotum in the general area where other species of *Uranotaenia* have a single median streak of bluish scales. In the single pupa from Baja California hair 1 of abdominal segment X was developed on both sides; this hair is normally present only in the genus *Toxorhynchites* (= *Megarhinus*). Such anomalies are of value not only to the comparative anatomist and taxonomist but may prove to be useful to the geneticist for they may represent mutations.

SUMMARY

An isolated population of the rare mosquito *Uranotaenia anhydor* Dyar, 1907 was discovered at Saratoga Springs at the south end of Death Valley in June, 1954, and was sampled in July, September and October. Large numbers of males and females were collected at Coleman lanterns and all immature stages were found in almost total darkness in mats of *Scirpus olneyi* growing on the margins of one of the lakes and a spring-fed pool. All the stages are described in detail and the complete chaetotaxy of all larval instars and the pupa is figured. Comparison with other populations of *anhydor* from San Diego Co., Calif., Baja California, Mexico, and St. David, Ariz. and several populations of *U. syntheta* Dyar & Shannon, 1924 from Texas reveals that all these populations are so close morphologically that they should be considered to form one species, *U. anhydor*, which is so distinct from other American *Uranotaenia* that it should be segregated as a separate series. The populations in the United States east of the Continental Divide, and in all probability those in eastern and central Mexico, constitute the subspecies *syntheta*, easily recognizable only in the adult stage by the thoracic ornamentation. The Saratoga Springs population cannot be considered to be in any way intermediate between the typical *anhydor* from San Diego Co. and *syntheta* but rather an extreme development of the former. It is suggested that the Saratoga Springs population, which is quite distinct morphologically and ecologically from the other western populations, has been isolated in the Amargosa drainage of the Death Valley System since late Pleistocene times, much like the relict populations of Cyprinodont fishes in that system, and that it may represent a third subspecies in the *anhydor* complex. However, because of the variability and remarkable morphological plasticity of the immature stages of this population, as well as the scarcity of material of other western populations, the Saratoga Springs population is not separated nomenclaturally from the typical *anhydor* for the present. The morphological characteristics of all known stages of United States populations of the complex are given as well as a review of their bionomics. It is suggested that related populations of mosquitoes may be separated by a multiple character index utilizing hair branching in the larva and pupa. Saratoga Springs is described in some detail in connection with observations on bionomics of *U. anhydor*, since this area appears ideally suited for studies on the ecology and genetics of natural populations. Two morphological anomalies, one in an adult female and the other in a pupa, were noted and it is suggested that they may represent mutations.

REFERENCES CITED

Belkin, J. N. 1953a. Mosquitoes of the genus *Uranotaenia* in the Solomon Islands (Diptera: Culicidae). Pacific Sci. 7: 312–91.

1953b. Corrected interpretations of some elements of the abdominal chaetotaxy of the mosquito larva and pupa (Diptera, Culicidae). Proc. Ent. Soc. Washington, 55: 318–24.

Belkin, J. N., and **W. A. McDonald.** 1955. A population of *Corethrella laneana* from Death Valley, with descriptions of all stages and discussion of the Corethrellini (Diptera, Culicidae). *In press.*

Breland, O. P. 1948. Notes on the mosquito, *Uranotaenia syntheta* Dyar & Shannon (Diptera: Culicidae). Mosquito News 8: 108–9.

1950. Additional studies on the larvae of *Uranotaenia syntheta* Dyar and Shannon (Diptera: Culicidae). Mosquito News 10: 25–8.

1954. Notes on the larvae of *Uranotaenia syntheta* (Diptera: Culicidae). Jour. Kansas Ent. Soc. 27: 156–8.

Brookman, B., and **W. C. Reeves.** 1953. New records of mosquitoes from Lower California, Mexico, with notes and descriptions (Diptera: Culicidae). Ann. Ent. Soc. Amer. 46: 225–36.

Dampf, A. 1943. Distribution y ciclo anual de *Uranotaenia syntheta* Dyar & Shannon en Mexico y description del hipopigio masculino (Insecta, Diptera). Rev. Soc. Mex. Hist. Nat. 4: 147–69.

Dyar, H. G. 1907. Report on the mosquitoes of the coast region of California, with descriptions of new species. Proc. U. S. Nat. Mus. 32: 121–9.

Dyar, H. G., and **R. C. Shannon.** 1924. The American species of *Uranotaenia* (Diptera, Culicidae). Insecutor Inscit. Menstr. 12: 187–92.

Eads, R. B., G. C. Menzies, and **L. J. Ogden.** 1951. Distribution records of West Texas mosquitoes. Mosquito News 11: 41–7.

Ferguson, F. F., and **T. E. McNeel.** 1954. The mosquitoes of New Mexico. Mosquito News 14: 30–31.

Freeborn, S. B. 1926. The mosquitoes of California. Univ. Calif. Publ. Ent. 3: 333–460.

Galindo, P., F. S. Blanton and **E. L. Peyton.** 1954. A revision of the *Uranotaenia* of Panama with notes on other American species of the genus (Diptera, Culicidae). Ann. Ent. Soc. Amer. 47: 107–77.

Griffith, M. E. 1952. Additional species of mosquitoes in Oklahoma. Mosquito News 12: 10–14.

Howard, L. O., H. G. Dyar and **F. Knab.** 1917. The mosquitoes of North and Central America and the West Indies. Carnegie Inst. Washington (Publ. 159), v. 4, p. 525–1064.

Hubbs, C. L., and **R. R. Miller.** 1948. The zoological evidence: correlation between fish distribution and hydrographic history in the desert basins of western United States *In* The Great Basin, with emphasis on glacial and postglacial times. B. Univ. Utah (Biol. Ser.) 10(7): 18–144.

McGregor, T., and **R. B. Eads.** 1943. Mosquitoes of Texas. J. Econ. Ent. 36: 938–40.

Mendenhall, W. C. 1909. Some desert watering places in southeastern California and southwestern Nevada. U. S. Geol. Surv., Water-Supply Pap. 224. 98 p.

Miller, R. R. 1948. The cyprinodont fishes of the Death Valley System of eastern California and southwestern Nevada. Misc. Publ. Mus. Zool. Univ. Michigan, 68. 155 p.

Porter, J. E. 1946. The larva of *Uranotaenia syntheta* (Diptera: Culicidae). Amer. Midl. Nat. 35: 535–7.

Randolph, N. M., and **K. O'Neill.** 1944. The mosquitoes of Texas. Texas State Health Dept. 100 p.

Rueger, N. E., and **S. Druce.** 1950. New mosquito distribution record for Texas. Mosquito News 10: 60–63.

Seaman, E. A. 1945. Ecological observations and recent records on mosquitoes of San Diego and Imperial Counties, California. Mosquito News 5: 89–95.

Thompson, D. G. 1929. The Mohave Desert region. U. S. Geol. Surv., Water-Supply Pap. 578. 759 p.

SLIDE MOUNTING OF COLLEMBOLA[1]

GRACE GLANCE

Division of Insects, Smithsonian Institution, Washington, D.C.

One of the difficulties encountered in the study of Collembola is the making of satisfactory and permanent slide mounts. If the specimens have been recently collected in 70 to 80 percent ethyl alcohol, the problem is not too great. Many preservatives used for other insects are so harmful to Collembola, that it is impossible to make satisfactory mounts if they are used. Most specimens collected in alcohol will float but when a drop or two of ether is added they will sink. It is imperative not to shake the vial to induce them to submerge, for the antennae especially break very easily. If vials are sent by mail or transported by any means, they should be full of alcohol, to prevent violent shaking and damage of specimens.

In handling specimens, forceps should not be used. A tiny lifter, at least an inch long, can be made from platinum or stainless steel wire with a diameter of 25 microns; one end is flattened and turned to almost a right angle, the other is inserted in a holder. It must be completely smooth and kept clean. Long-handled Asko canal finders used by dentists, are also most satisfactory for the transfer of specimens, especially to the mounting medium. They can be bent to a suitable curve with the fingers, and if kept clean, will not corrode. With practice, specimens with long legs are lifted from one reagent to another by inserting the tip of the canalfinder between pairs of legs, or by hooking a bent leg; with a sudden jerk, the specimen is taken from one liquid and quickly placed in the next. Microculture slides with matte finish and with a depression of 3 x 16 mm. are adequate for the small amount of reagents needed to treat single specimens. It is very simple and safe to lift a specimen from one slide to another under the binocular. On the matte surface, a pencilled number, which correlates specimen with collection data, is easily erased.

Specimens which are light in color and which do not have a well-developed system of muscles, I transfer to a 20 percent acetic acid solution for 15 minutes or longer, even over night. Then they are mounted singly in Hoyer fluid, the formula for which was given by Bonet, 1931 as follows:

Distilled water	50	grams
Gum arabic	30	"
Chloral hydrate	200	"
Glycerine	20	"

The fluid will have to be filtered. With practice, one learns how much fluid is required on a slide. The mount must be thin enough

[1]Accepted for publication April 12, 1955.

so that an oil immersion objective can be used, but a slight excess of fluid must flow beyond the edge of the cover glass, like a ring, to form a seal. Hoyer fluid will clear specimens to a certain degree over a period of time. This action will be accelerated by placing slides, for a few days, in an electric oven at 45° C.

For those specimens which are quite opaque by reason of their heavy muscles, such as larger Isotomidae and most Entomobryidae, some preliminary clearing is needed, as Hoyer fluid will not clear sufficiently. Never use caustic; it destroys delicate structures. When the arrangement and number of the eyes cannot be seen in a Hoyer mount, then a specimen will have to be sacrificed; mount it in 5 percent KOH solution and examine it immediately.

The first mention I have noted of the use of lactic acid as a clearing agent for Collembola was given by Handschin in 1924. I use a 50 percent solution. For most specimens cold treatment will suffice; the specimens should remain in the solution just long enough to lose some of their opaqueness. The length of time varies from one to several hours. Prolonged treatment tends to swell specimens to the point of bursting. Those that have dried out can usually be restored by adding a drop or two of lactic acid to the alcohol, and by following, in several days, with cold lactic acid. When the above procedure does not seem to produce any clearing, the lactic acid is heated. Pyrex dishes 50 mm. in diameter and 23 mm. deep, with handles, are filled about half full and covered with watch glasses. The lactic acid must not boil, so a hot plate at low temperature, covered with an asbestos pad, serves the purpose. Clearing is rapid; usually by the time drops of liquid condense on the watch glass, the specimen is ready to be transferred as above to acetic acid, then mounted in Hoyer fluid. Such slight lactic acid treatment does not change appreciably the natural color of the specimen, nor does Hoyer fluid.

For *Achorutes* (=*Hypogastrura*), *Anurida*, and the like, Onychiuridae, certain Isotomidae, and Sminthuridae, Hoyer mounts are not quite adequate. There is so much that cannot be seen with certainty. I treat such specimens with hot lactic acid, as described, for an hour or longer, until all the body contents have been dissolved and removed; it is not only the heat, but also the movement of the specimen in the liquid, that accomplishes this. Lactic acid is filtered and reused until it becomes too yellow, but the volume is kept approximate, even while being heated. Before a specimen is placed in lactic acid, it is punctured with the canalfinder in the region of the second pair of legs. Sminthuridae and some Isotomidae are beheaded, and so need not be punctured; on the slide, the head is mounted dorsally, the body laterally. In other cases where dorsal and lateral views are required, I mount two specimens on the same slide. From lactic acid, specimens go to the acetic acid solution for half an hour or longer and then are stained with acid fuchsin, formula of Gage, 1919:

Acid fuchsin	0.5 gram
HCl, 10 percent	25 cc.
Distilled water	300 cc.

They may remain in stain even over night without being overstained. Place next in 95 percent ethyl alcohol, for about five minutes; this also serves to wash out any loose stain. Transfer to clove oil for some seconds, just long enough for the oil to penetrate the antennae, legs, and spring. Then mount at once in damar. The clove oil must be very pale in color, not discolored with age; I use it because it is tolerant of some moisture, and is very mild in its action. I prefer damar to balsam because it does not become yellow with age. The procedure just described does not always produce good mounts. Occasionally, specimens will burst while being heated, but even then, one is still able to mount them and see the characters. It can not be used for heavy-bodied specimens like *Neanura*, or for large Isotomidae or Entomobryidae; the latter two lose practically all their vestiture.

I cannot stress too strongly the need for keeping all equipment absolutely clean, and all reagents filtered. The tiniest particles of any material will cling to hairs or obscure the structure of claws, mucrones, and the like. When mounting, it is well to keep the microculture slides in Petri dishes, or if working on a plate glass surface, to cover the slides with a Petri dish; this will keep out dirt, and prevent evaporation of reagents.

PRICES OF REPRINTS

See the December, 1955, Bulletin of the Entomological Society of America for revised schedule of prices for reprints of papers accepted for publication after January 1, 1956.

THE NEARCTIC COMPONENTS OF THE TRIBE ACANTHOCININI (COLEOPTERA: CERAMBYCIDAE). PART I.

LAWRENCE S. DILLON
Department of Biology, A. & M. College, College Station, Texas

Because the members of this tribe are extremely variable in coloration and because the species often closely resemble one another, there has been considerable confusion in the literature as well as in collections. Hence a need for a monographic revision has long been felt.

For the present study over 4000 specimens have been examined. Loans of material have been received from the following: American Museum of Natural History [AMNH]; Ross Arnett [RA]; California Academy of Sciences [CAS]; Colorado Agricultural and Mechanical College [CAM]; University of Colorado Museum [Col.]; Cornell University [CU]; N. M. Downie [NMD]; University of Idaho [IU]; David Kissinger [DGK]; Lionel Lacey [LL]; University of Kansas [KU]; University of Miami [Miami]; University of Minnesota [Minn.]; Ohio State University [OSU]; Pee Dee Experiment Station [PDES]; Agricultural and Mechanical College of Texas [TAM]; United States National Museum [USNM]; Utah Agricultural Experiment Station [UAS]; State College of Washington [WSC]; and University of Wisconsin [WU].

CHARACTERISTICS OF THE TRIBE

Elongate, ovate or oblong, ranging from robust in *Lagocheirus* to quite slender in *Lepturges* and from cylindrical (*Leptostylus*) to quite depressed (*Hyperplatys*), in length varying from 4 to 26 mm. (but most species under 15 mm.). Head subequal in width to extreme apex of prothorax, transverse when viewed from above, usually impressed medially on vertex behind antennal tubercles; front more or less rectangular, mostly transverse, but sometimes erect, often slightly narrowed between and below eyes; antennal tubercles subapproximate at base, rather strongly divergent apically; antennae very variable in length, ranging from shorter than body to over three times body length, fimbriate beneath or not, rarely one or more segments may be tufted; scape elongate, usually extending at least to behind middle of pronotum, slender, subcylindrical, without cicatrix (in North American forms). Pronotum at least slightly transverse, often strongly so; sides usually very narrowly constricted at extreme apex; lateral tubercles almost always present, placed anywhere from middle to extreme base. Elytra with humeri slightly prominent; apices separately rounded, truncate, or emarginate (bidentate in *Hyperplatys*); each often with four more or less distinct costae, conjoined before apex, sometimes studded with tubercles; hind wings present. Prosternal process arcuate from fore to rear, variable in width from genus to genus, as is also the mesosternal process, which is never tuberculate. Fifth abdominal sternite sometimes greatly elongated in the female. Procoxal cavities closed behind, laterally rounded or feebly argulated; mesocoxal cavities closed or narrowly open laterally. Legs variable in length, usually successively longer from front to rear; femora strongly clavate, subpedunculate or pedunculate; tarsal claws divaricate (not quite so in *Coenopoeus*).

Of these characters, the rounded or only partially angulated procoxal cavities, the strongly clavate, subpedunculate femora, the divaricate tarsal claws, and elongate, slender scape are most diagnostic.

MORPHOLOGICAL FEATURES

Even among the relatively limited number of North American genera, it is possible to trace what appears to have been the evolutionary development of certain morphological traits. A number of structures, such as the prosternal process, for example show a continuing trend from the more primitive to the most advanced forms, while others, as for example the long, erect hairs on elytra or legs, are erratic in their appearance among the genera. It might be of interest to note some of the more salient of these.

On the head several organs show definite trends. The labrum in such primitive genera as *Lagocheirus* is more than half as broad as the front, but is gradually reduced in width in more advanced forms until in *Dectes* it is only about one-fourth as broad as front. Around the eye of the former genus, there is almost a continuous row of setigerous punctures (possibly sensory in function) but in all the genera following *Sternidius* these are reduced to but two or three near each eye. Facet size in the eye shows considerable fluctuation, but is erratic, being quite fine in *Lagocheirus*, *Dectes*, and *Neacanthocinus*, moderate in size in *Sternidius*, and rather coarse in *Lepturges*. Eye-size, while often useful in distinguishing genera, shows no marked evolutionary trends, with the sole exception that there is some correlation with primitiveness in the breadth and proximity of the upper lobes. In more advanced forms, these tend to be narrow and widely separated, with the converse true in lower genera. The antennal tubercles show almost no variation within the tribe.

On the pronotum the position of the lateral tubercles is of especial import. Primitively, these are placed at the middle of the sides, gradually moving farther and farther toward the base with increasing specialization, until in *Lepturges*, they are located at the basal angles. Their size, like the size and number of discal tubercles, is inversely correlated with advanced development. In *Lagocheirus* and *Leptostylus* there are seven very prominent tubercles on the disk, which become reduced only in prominence in *Leptostylopsis*, but which are further diminished in size and number (to three) in *Astylidius*. In *Sternidius*, there remain but three slight traces of these tubercles, which disappear entirely in *Lepturges*, *Hyperplatys*, and *Dectes*. Furthermore, on this same sclerite, the apical and basal transverse sulci run a parallel course in diminution and obsolescence. While both are deeply impressed and well defined in the primitive genera, the apical one disappears entirely by the time *Sternidius* is reached, the basal one remaining as a broad, shallow impression here and through *Hyperplatys* but becoming quite obsolete in *Dectes*. Hence the pronotum is very roughly sculptured primitively, while in the advanced condition it is quite smooth and simple.

The prosternal process in *Trichastylopsis* and *Glaucotes* is angulated each side, the angulation projecting into or over the procoxa—a condition identical to that found among a few of the more primitive genera of the Monochamini. However, the two genera involved here have in other respects attained a degree of specialization somewhere between that of *Leptostylopsis* and *Astynomus*, having merely retained this primitive character incidentally. In all genera the prosternal process exhibits a marked trend of decreasing width, proceeding from a breadth subequal to a procoxal cavity to a sublinear condition in the most highly evolved forms. The mesosternal process shows an almost identical series of progression.

On the elytra the prominence of the costae and the costal tubercles and of the basal gibbosities is to a rather marked degree inversely proportional to the degree of specialization. In *Leptostylus* the costae are provided with subconical tubercles, which become somewhat reduced in *Leptostylopsis*, while in such genera as *Sternidius*, *Styloleptus*, and *Canonura* the costae are nearly simple or the costal tubercles are evident largely as tufts of short hairs. In *Dectes*, finally, the costae themselves have completely disappeared.

ACKNOWLEDGMENTS

Many persons aided the writer by loaning him specimens from their personal insect collections or from collections under their care. For their generous cooperation in this manner, he wishes to express his thanks to the following: Dr. M. Cazier, Mrs. C. Vaurie, Dr. R. Arnett, Dr. H. B. Leech, Dr. T. O. Thatcher, Dr. H. G. Rodeck, Dr. H. Dietrich, Dr. N. M. Downie, Dr. W. F. Barr, Mr. D. G. Kissinger, Mr. L. Lacey, Dr. C. E. Michener, Dr. H. F. Strohecker, Dr. C. E. Mickel, Prof. J. N. Knull, Mr. V. M. Kirk, Dr. G. F. Knowlton, Dr. M. T. James, Prof. E. W. King, Dr. J. J. Davis, and Prof. H. J. Reinhard.

KEY TO THE NEARCTIC GENERA

1. Prosternal process one-half or more than half as wide as a procoxal cavity 2
   Prosternal process less than half as wide as a procoxal cavity 10
2. Prosternal process near middle angularly expanded each side into procoxae 3
   Prosternal process not expanded laterally 4
3. Elytra with tufted tubercles; eye with lower lobe taller than gena ..... **Trichastylopsis**
   Elytra without tubercles or tufts, but rather densely covered with short, erect setae; eye with lower lobe shorter than gena ..... **Glaucotes**
4. Pronotal lateral tubercles situated at the middle of the sides 5
   Pronotal lateral tubercles situated at least slightly behind the middle 6
5. Pronotum with five or more strongly prominent discal tubercles which more or less compare with the lateral tubercles in size and eminence; body length exceeding 15 mm ..... **Lagocheirus**
   Pronotum with discal tubercles less prominent than lateral ones; body length not over 12 mm. ..... **Leptostylopsis**
6. Pronotal disk uniformly, rather densely, finely punctate 7
   Pronotal disk impunctate or irregularly punctate. 8
7. Antennae with third segment at least slightly shorter than first ..... **Amniscus**
   Antennae with third segment at least slightly longer than first ..... **Astylidius**
8. Pronotum and elytra with many prominent tubercles; pronotal discal tubercles rivaling its lateral ones in size; antennae at most feebly surpassing elytral apex, sixth segment only half as long as first ..... **Leptostylus**
   Elytra at most with small tufted tubercles; pronotal discal tubercles not nearly so prominent as its lateral ones; antennae at least one-fourth as long as body, the sixth segment about two-thirds as long as first 9
9. Pronotum on disk with five to seven tubercles which are rather prominent, its surface irregularly punctate; body size 7 to 12 mm. ..... **Leptostylopsis**
   Pronotal disk with three obtuse tubercles which are not very prominent, rest of surface finely, uniformly punctate; body size not over 7 mm. ..... **Astylidius**
10. Prosternal process about one-fourth or one-third as broad as a procoxal cavity 11
    Prosternal process less than one-fourth as broad as a procoxal cavity 18
11. Front with lower margin strongly bilobed; tarsal claws not strictly divaricate, meeting at a slight angle ..... **Coenopoeus**
    Front with lower margin not bilobed; tarsal claws strictly divaricate 12
12. Pronotum with basal transverse sulcus abbreviated on each side by the lateral tubercles 13
    Pronotum with basal sulcus continuing behind lateral tubercles 14
13. Lower ocular lobe twice as tall as gena, upper lobe as broad as upper interocular space ..... **Nyssodrysina**

Lower ocular lobe not more than one-fourth again as tall as gena, upper lobe only half as broad as interocular space . . . . . **Astyleiopus**

14. Elytra with long, erect hairs . . . . . **Graphisurus**
Elytra without long, erect hairs 15

15. Elytral apices distinctly bidentate; body strongly depressed above; front one and one-half to two times (usually the latter) as wide as high . . . . . **Hyperplatys**
Elytral apices sometimes emarginate with angles slightly prominent, but never strictly bidentate; body not strongly depressed; front not more than half again as wide as high 16

16. Pronotum with lateral tubercles placed just behind middle, sides subparallel; elytral costae provided with rather prominent tubercles . . . . . **Amniscus**
Pronotum with lateral tubercles absent or placed at basal third, in either case sides tapering to apex and constricted at base; elytral costae sometimes with distinct tubercles 17

17. Pronotum without lateral tubercles or lateral teeth, sides broadly arcuate at basal third; elytral costae with distinct tubercles; pronotum with a distinct apical transverse sulcus . . . . . **Styloleptus**
Pronotum with lateral tubercles distinct and usually dentate; elytral costae at most with very feeble tubercles; pronotal apical sulcus wanting . . . . . **Sternidius**

18. Mesosternal process one-third or more as wide as a mesocoxal cavity, usually two or more times as broad as the prosternal process 19
Mesosternal process much less than one-third as broad as a mesocoxal cavity, not much broader than prosternal process 25

19. Elytra with long, erect hairs . . . . . **Graphisurus**
Elytra without long, erect hairs 20

20. Antennae beneath only feebly fimbriate, the basal segments each with but one or two setae apically . 21
Antennae beneath densely fimbriate on at least first five segments 23

21. Pronotum nearly twice as wide across lateral tubercles as long, the latter large, prominent, placed just behind middle; pronotal disk without tubercles, tumid each side; antennae with first three segments equal in length . . **Sternidocinus**
Pronotum usually not nearly twice as broad as long, lateral tubercles small, if somewhat prominent then placed at basal third; pronotal disk with tubercles; antennae with third segment longer than first or fourth shorter than third . . . 22

22. Prothorax subcylindrical, of nearly equal width apically as at base, lateral tubercles low, unarmed, placed at middle, disk with five tubercles, the median one subequal to those on sides of pronotum . . . . . **Pseudostylopsis**
Prothorax not subcylindrical, sides tapering to apex and strongly constricted at base, lateral tubercles usually armed, placed at basal fifth, disk with three feeble tubercles . . . . . **Sternidius**

23. Elytra on basal fourth and on humeri covered with granulate-punctures . . . . . **Canonura**
Elytra sometimes granulate-punctate on humeri but not on disk 24

24. Elytra distinctly punctate nearly to apex, basal gibbosity not crested . . . . . **Neacanthocinus**
Elytra impunctate behind middle, basal gibbosity with an elongate, brush-like crest . . . . . **Tylocerina**

25. Elytra with erect hairs 26
Elytra without erect hairs 29

26. Pronotum not more than one-third again as wide across lateral tubercles as long, disk without tubercles, basal transverse sulcus wanting; elytral erect hairs short . . . . . **Dectes**
Pronotum at least one-half again as wide as long, disk often with tubercles, basal transverse sulcus usually distinct; elytral erect hairs elongate 27

27. Pronotum with lateral tubercles scarcely evident, indicated only by the retrorse teeth; eyes with upper lobes separated by four times their width . . . . . **Valenus**
Pronotum with lateral tubercles prominent; eyes with upper lobes separated by less than four times their width 28

28. Entire leg, front, and antennal scape covered with long, erect hairs . . . . . **Ceratographis**
Legs (except on trochanter), front, and antennal scape (except usual fringing hairs beneath) devoid of long, erect hairs . . . . . **Eutrichillus**

29. Elytral apices bidentate; pronotum wider medially than across lateral tubercles . . . . . **Hyperplatys**
Elytral apices not bidentate; pronotum widest across lateral tubercles 30

30. Pronotum with basal transverse sulcus continuous across disk and down sides; antennae with third segment distinctly longer than first . . . . . **Urgleptes**
Pronotum with basal sulcus confined to disk, abbreviated each side by the lateral tubercles; antennae with third segment usually shorter than first 31

31. Eye with lower lobe erect; antennae with third segment longer than first; mesotarsal first segment shorter than remaining segments together . . . . . **Maculurges**
Eye with lower lobe transverse; antennae with third segment shorter than first; mesotarsal first segment at least as long as rest combined . . . . . **Lepturges**

Lagocheirus Erichson

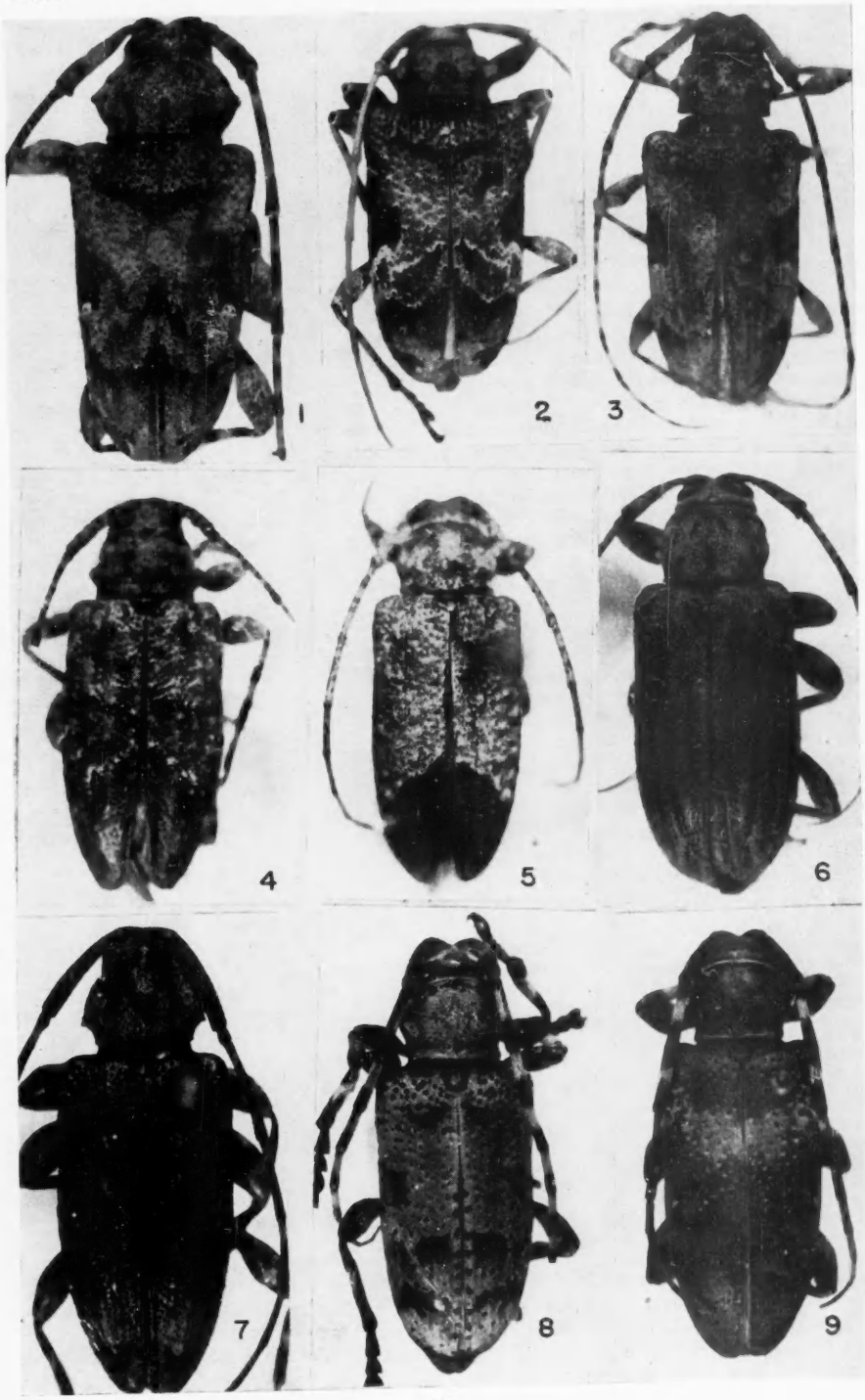
Lagocheirus Erichson, 1847, Archiv. Naturg., 13(1): 144 Thomson, 1860, Class. Ceramb., p. 6, 9: 1864, Syst. Ceramb., p. 355. Lacordaire, 1872, Gen. Col., IX, p. 759, 762. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc., 23: 115.

Lagochirus Erichson. LeConte, 1873, Smiths. Misc. Coll., XI(265): 337. Horn, 1880, Trans. Amer. Ent. Soc., 8: 117. Bates, 1880, Biol. Centr. Amer., Col. V, p. 144. Casey, 1913, Mem. Col., IV, p. 303.

Large or very large, robust, subdepressed beetles with head punctate only around eyes; front ranging from one-fourth to one-half again as broad as tall; eyes with lower lobe subquadrate, erect or transverse, at least slightly taller than gena. Pronotum strongly transverse, often twice as broad across lateral tubercles as long, lateral tubercles robust, prominent, situated at middle of sides; disk punctate, with five prominent tubercles; transverse sulci shallow, the apical one placed close to margin. Scutellum subtriangular, truncate or rounded at apex. Elytra with basal gibbosity quite evident; disk distinctly punctate, costae not prominent, bearing numerous tufted tubercles especially basally and apically, one or two basal ones on gibbosity much larger than the

EXPLANATION OF PLATE

FIG. 1. Lagocheirus texensis, spec. nov.
FIG. 2. L. stroheckeri stroheckeri, spec. nov.
FIG. 3. L. procerus Casey.
Fig. 4. Astylidius versutus downiei, subspec. nov.
FIG. 5. Amniscus perplexus Haldeman.
FIG. 6. Glaucotes yuccivorus Fall.
FIG. 7. Astyleiopus variegatus Haldeman.
FIGS. 8–9. Coenopoeus palmeri LeConte, showing range of coloration.


1
2
3
4
5
6
7
8
9

rest; apices broadly truncate, the angles sometimes subdentate; humeri prominent. Prosternal process two-fifths or one-half as broad as a procoxal cavity, longitudinally concave; mesosternal process ranging from four-fifths as broad to slightly broader than a mesocoxal cavity; fifth sternite as long as or slightly longer than fourth in male, distinctly longer in female. Legs successively longer posteriorly; femora robust, clavate apically, pedunculate basally; tarsi with first segment slightly shorter than next two together, on mesotarsi, however, a little longer than the second and third combined; in male protarsi strongly expanded and fringed and protibiae densely fringed apically as well. Antennae ranging from one and two-thirds to more than twice as long as body, slender, fringed beneath only on first two segments and sometimes at extreme apex of third; scape slightly elongate, extending a little beyond middle of pronotum, slender, gradually clavate apically; third segment about one-sixth longer than first; fourth subequal to (or feebly longer than) first, rest gradually shorter, the sixth usually bearing a tuft at apex in the male.

Genotype: Lagocheirus plantaris Erichson, by monotypy.

Remarks: Many of the species in this genus resemble one another very closely and are difficult to separate; the genus is greatly in need of a revisional study on a comprehensive basis.

The distinguishing characteristics of the genus are to be found in the shape of the front, the broad pro- and mesosternal processes, and in the location of the pronotal lateral tubercles, the latter being situated at the middle of the sides. In addition, the strong sculpturing of the pronotal disk, the presence of tufted tubercles on the elytra, and the antennal formula are diagnostic.

KEY TO NORTH AMERICAN SPECIES

1. Antennae with all segments uniformly pubescent, not annulate; elytra with a black macula or streak each side of scutellum; Florida . . . . . **stroheckeri**
   Antennae with at least third or fourth and several following segments annulated or biannulated; elytra without black markings adjacent to scutellum 2
2. Eyes with lower lobe erect, upper interocular space greater than width of an upper lobe; antennal segments beyond sixth suddenly shortened; pronotal punctures outlined with whitish pubescence; Texas . . . . . **texensis**
   Eyes with lower lobe transverse, interocular space at most equal to width of an upper lobe; antennal segments beyond sixth only feebly diminishing in length; pronotal punctures not outlined with white; California . . . . . **procerus**

Lagocheirus stroheckeri stroheckeri Dillon, spec. nov.

Fig. 2

Lagochirus araneiformis (Linné). Horn, 1880, Trans. Amer. Ent. Soc., 8: 117. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc., 23: 115 [misdet].

Male. Fuscous or piceous, densely covered with short, silky, brownish gray or fulvous pubescence. Head, body beneath, legs, and antennal scape finely mottled with dark brown. Head above and on front often clouded with brown; between upper lobes of eyes with a pair of small, velvety-black maculae, sometimes more or less coalescent. Pronotum sometimes broadly clouded with dull brown, sometimes entirely fulvous, at other times intermediate conditions prevail; on disk with two oblique, velvety black lines anteriorly, one each side of middle, and two similar but angulate ones at base; apical and basal margins at middle more or less infuscate. Scutellum brown, with two large, rounded, blackish (sometimes velvety) maculae at base. Elytra usually broadly clouded with brown across base, with a short, velvety black line at scutellum and another at base continuing that at base of pronotum, sometimes with a blackish, transverse streak at basal sixth, and just behind middle near suture a small, elongate, velvety black macula; continuing laterad from this macula, a macular band of dark brown, often present and at apical quarter a sinuous line of the same color extending to the lateral margin; apical portion often clouded with dull brownish to a greater or lesser extent, rather densely sprinkled with black maculae, sometimes outlined with white; similar maculae occur to some degree on the basal half as well; sides with a large fuscous macula extending from base to behind middle and posteriorly onto disk, outlined behind with ashy. Legs brownish pubescent; femora annulate with ashy before apex; tibiae similarly annulate at middle; tarsi with first two segments ashy, the rest fuscous. Antennae uniformly ashy pubescent, without annulae.

Entire upper surface minutely, densely alutaceous and punctulate. Head with a number of setigerous punctures bordering upper lobe of eyes; front with a row of similar punctures near each eye and with fine, sparse punctures over entire surface, one-third again as broad as tall; eyes with upper lobes separated by a little more than one of their widths, lower lobe subquadrate or feebly transverse, about one-half again as tall as gena. Pronotum twice as wide across tubercles as long, sides irregular, lateral tubercles broad, prominent, acute, armed with a short tooth at apex; disk with five quite prominent, subequal tubercles, two near apex and three behind middle, and near sides apically an obliquely transverse, cariniform tubercle that may be wanting occasionally, medially with a punctate region containing about twenty fine punctures extending laterad between the discal tubercles and connecting with an area of larger punctures; at apex a single row, and at base a double row, of punctures which gradually increase in size laterally. Elytra with well separated, rather coarse, granulate punctures at base, which gradually be-

come simple and finer to middle, nearly entirely disappearing before apical third; basal gibbosity broad, not strongly pronounced, bearing three tuberculated and tufted carinae, the sutural one not prominent but always discernable; disk behind middle with four evident costae; apices broadly, squarely truncate, the marginal angle subprominent or dentate. Prosternal process nearly half as wide as a procoxal cavity; mesosternal process as broad as a mesocoxal cavity; fifth sternite subequal to fourth, narrowly emarginate at apex. Antennae two-thirds again as long as body, fifth segment attaining elytral apex (or nearly so in smaller specimens); scape extending to basal third of pronotum; third segment one-sixth longer than first; fourth very slightly longer than first; fifth one-sixth and sixth one-third, shorter than first, the sixth bearing a scantily-tufted nodule at apex; rest very feebly and gradually diminishing in length.

Female. As male, but fifth sternite distinctly longer than fourth, narrowly emarginate at apex; the antennae only one-third again as long as body, the eighth segment slightly surpassing elytral apex; third segment subequal to first; fourth slightly shorter and the following gradually distinctly diminishing in length; sixth segment not nodulose.

Length 14–23 mm.; width 6–10 mm.

Holotype: Male; Miami, Florida, November 15, 1947 [Miami].

Allotype: Female, Dade Co., Florida, May 31, 1951 [Miami].

Paratypes: 2, Matheson hammock, Dade Co., Florida, May 4, 1948 [Miami]; 4, same data as allotype [Miami]; 1, Coral Gables, Florida, Sept., 1948 [Miami]; 1, Florida [KU]; 1, Biscay Bay [USNM]; 1, Key West, March 17, 1912 (E. A. Schwarz) [USNM]; 1, Miami [CU].

Remarks: Named for Dr. H. F. Strohecker, of the University of Miami, who so kindly sent the writer many specimens, including the fine series listed above.

While this species very closely resembles *araneiformis*, described by Linné from Jamaican specimens, it differs from a female specimen at hand from that locality in a number of minor, but consistent, characters. The Jamaican form is grayer, has the scutellum with only the basal angles dark, and has the lower ocular lobes vertical, four-fifths again as tall as the gena, the upper lobes separated above by less than one of their widths; the discal tubercles of the pronotum are less prominent and the disk is more coarsely and densely punctate. Moreover, the elytra are quite closely punctate at base, the punctures continuing to the apex and there are no circumscutellar black marks. The males possibly show further distinctive characters.

Lagocheirus stroheckeri granulatus Dillon, subspec. nov.

Male. As the typical form but the maculation of the upper surface rather obscure, due to the nearly fuscous color of the general body pubescence. On the elytra the postmedian lateral white markings are more extensive and form an irregular oblique area. But the chief distinguishing characteristic lies in the granulation of the basal punctures on the elytra; these granules are nearly as large as the punctures (which themselves are coarser than in the nymotype) and extend to basal third on the disk and nearly to the middle on sides.

Length 13.5 mm.; width 6.8 mm.

Holotype: Male; Texas [USNM].

Lagocheirus texensis Dillon, spec. nov.

Fig. 1.

Male. Fuscous, densely covered with brownish pubescence, variegated with fulvous; head, sides of prothorax, body beneath, legs and first three segments of antennae, finely and rather densely mottled with brown. Head above largely fulvous, with a pair of small, black maculae between eyes; front near eyes with a row of several small, black maculae. Pronotum brown and ochraceous variegate, with whitish points around the punctures; apically with a strongly oblique, velvety black bar each side of middle which is usually reflexed apically, basally with a slightly angulated, velvety vitta each side of middle extending from behind the apex of the postmedian tubercle to base, gradually widened behind, ending anteriorly in a brownish macula or oblique vitta; behind lateral tubercle a short, blackish vitta and low on the sides near apex, a small, similar macula. Scutellum dark brown, margined each side with a short, arcuate, black vitta which is in turn margined mesially with a fine, whitish streak. Elytra with brown basal area rather well defined posteriorly, forming a fairly uniform, common, inverted triangle. The apex of which is accentuated by a common, darker band which is indistinctly prolonged along the suture, without circumscutellar black markings but with a black macula at middle of each base continuing basal pronotal vitta; disk to apical brown portion largely gray-fulvous, feebly tinged with brown and usually with white points around the punctures, posteriorly and near suture with whitish streaks; behind middle a short, black streak nearly parallel to suture and another streak nearly identical to this in length, width, and position but at apical fourth; the usual apical band is otherwise indicated only by an angulate bar or series of black dots near edge of disk; entire disk and lateral margin sprinkled with black tufts and rounded maculae; sides before humerus with a conspicuous black spot, thence to middle with a dark brown area which extends onto disk, ending in a fuscous streak there, on disk posterior margin strongly incised, sides narrowly margined with whitish. Body beneath and legs ashy pubescent, irregularly

tinged with fulvous; femora usually annulate near middle and before apex with brownish; tibiae annulate at basal third and broadly at apex with brownish; tarsi ashy pubescent, entire third and base of last segment dark brown. Antennae with scape ashy pubescent, fuscous annulate at apex; third to fifth or sixth segment biannulate with ashy; rest broadly, singly annulate with ashy, the annulation placed closer to base than to apex.

Entire upper surface minutely, densely alutaceous. Head above with but one or two setigerous punctures between eyes, with two or three below lower lobes and three or four on front near eye; front otherwise impunctate, one-half again as wide as long; eyes with lower lobe erect, about one-third again as tall as gena, upper lobes separated by a distance slightly greater than one of their widths. Pronotum not quite twice so broad as long, sides subparallel, lateral tubercles broad at base, obtuse, unarmed at apex; disk finely, very sparsely punctate, toward sides punctures becoming a little coarser and slightly denser, punctures in basal row medially about twice as large as those at middle of disk, with two tubercles before apex and three behind middle, more or less equal in prominence, the lateral basal ones somewhat transverse; apically near sides often a low, cariniform tubercle. Elytra rather coarsely, densely granulate-punctate in basal dark area, thence becoming simple and suddenly finer, gradually growing finer apically but distinctly attaining apex; basal gibbosity broad, feebly elevated, with three rows of tufted tubercles, the usual costae only faintly visible; disk well sprinkled with tufted tubercles arranged along suture and on four poorly indicated costae; apices broadly truncate, the angles sometimes slightly prominent. Prosternal process two-fifths as wide as a procoxal cavity; mesosternal process four-fifths as broad as a mesocoxal cavity, feebly dilated posteriorly; fifth sternite nearly one-half again as long as fourth, bilobedly emarginate at apex. Antennae about two-fifths again as long as body, the sixth segment feebly surpassing elytral apex; scape slightly exceeding the apex of the pronotal lateral tubercle; third segment one-seventh again as long as first; fourth subequal to first; fifth one-fifth and sixth two-fifths shorter than first, the sixth with a long process apically, in length subequal to the width of that segment, bearing a tuft of hairs, denser proximally; seventh segment two-fifths as long as first; rest very gradually shorter.

Female. As male, but protarsi not tufted or expanded; fifth sternite not differing; the antennae scarcely longer than body, the ninth segment attaining elytral apex, fourth segment one-tenth shorter than first, fifth two-thirds and sixth one-half, as long as first, the latter without an apical process.

Length 15–17 mm.; width 5–7 mm.

Holotype: Male, Dimmit Co., Texas, May 30, 1934 (S. E. Jones) [TAM].

Allotype: Female, same data as holotype but September 18, 1933 [TAM].

Paratypes: 2; topotypic, May 22, 1934 and September 10, 1933 (S. E. Jones) [TAM].

Remarks: From the other species with biannulated basal antennal segments, this form is distinguished by the following combinations of characters: Pubescence above generally light brownish. Pronotum with apical markings strongly oblique, usually strongly angulate and reflexed to apical margins, basal markings gradually widened behind, not attaining apex of lateral discal tubercle; on sides with a short macula behind lateral tubercles; disk very sparsely, finely punctate, the punctures outlined with white. Scutellum margined each side with blackish, and these markings in turn margined internally with whitish. Elytra with coarse, dense punctures in basal dark area, which become suddenly finer thence and attain apex; post median sutural black markings linear, short, feebly angulate, nearly paralleling suture, the ones at apical quarter similar in length and position but not angulate. Antennae with the nodule on sixth segment long, and rather heavily tufted, especially proximally.

Lagocheirus procerus Casey

FIG. 3

Lagochirus procerus Casey, 1913, Mem. Col., IV, p. 304.

Male. Very similar to *L. texensis*, differing only as follows: Pubescence usually bright gray or bright brown-gray. Pronotum usually distinctly variegated with light fulvous; anterior bars placed even more strongly oblique, not attaining apical margin but often similarly angulately reflexed, basal streaks broader, short, reaching only to base of basal tubercle, continued to its apex by a brown cloud, median tubercle with a distinct glabrous line or macula. Scutellum nearly concolorous, with a faint, brownish macula at each side of middle at base. Elytra with basal brown area narrow, extending only to basal sixth, the transverse dark bar vague, linear, elongate; post median black streaks short, more strongly oblique, the ones at apical fourth nearly parallel to suture, irregular; apical patch pale brown, bordered anteriorly on lateral half by an angularly sinuous line. Antennae with segments beyond sixth or seventh nearly entirely cinereous pubescent.

Head with fine setigerous punctures scattered entirely around eye; front only about one-fourth again as wide as high; eyes with lower lobe transverse, one-sixth again as tall as gena, upper lobes separated above by a distance which is slightly less than one of their widths. Pronotum twice as broad as long; disk quite sparsely, finely punctate, on sides of disk punctures some-

what denser but not coarser. Elytra very sparsely, sublinearly, finely punctate, the punctures in basal area slightly coarser and granulate. Prosternal process nearly half as broad as a procoxal cavity, deeply concave; mesosternal process slightly broader than a mesocoxal cavity. Fifth sternite just as long as fourth, apex bilobedly emarginate. Antennae three-fourths again as long as body, the fifth segment surpassing elytral apex; scape extending two-thirds across pronotum; first segment two-fifths again as long as first; fourth feebly longer than third; fifth one-fifth longer than first; sixth subequal to first with a very short nodule at apex, fringed with long hairs; rest very feebly diminishing in length.

Female. As male but protarsi not expanded or fringed; fifth sternite one-half again as long as fourth, apex deeply emarginate; antennae only slightly longer than body, the eighth segment attaining elytral apex, third segment one-tenth longer than first, fourth subequal to first, fifth one-fifth shorter than first, and sixth three-fifths as long as first, the latter without apical process, apical segments not entirely cinereous pubescent but dark at bases and apices.

Length 22–25 mm.; width 8–9.5 mm.

Type locality: "Unlabelled, but probably from Lower California."

Distribution: Southern and Lower California. California: 1; no further data [KU].

Remarks: Several specimens from Lower California are at hand which agree in all essentials with the Californian example.

From other forms with biannulate antennae, the antennal formula and coloration, the short antennal process, the pronotal markings, and the nearly unicolorous scutellum will be especially helpful in distinguishing this species.

Leptostylus LeConte

Leptostylus LeConte, 1852, Proc. Acad. Nat. Sci. Philadelphia, (2)2: 168. Horn, 1878, Trans. Amer. Ent. Soc., 8: 119. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 23: 116.

Amniscus Haldeman, 1847, Trans. Amer. Philos. Soc. (2)10: 46 [*ex parte*].

Moderately small, rather robust, convex beetles. Head with front widest slightly below eye, strongly narrowed below, and feebly narrowed between eyes, one-half again as broad as high; eyes with lower lobe feebly transverse or subquadrate, a little shorter or slightly taller than gena. Pronotum broadest just behind middle, one-half again as wide as long, lateral tubercles just behind middle, low and rounded; disk with seven tubercles, all but lateral discal ones strongly elevated, often exceeding lateral marginal ones in prominence; disk apparently largely impunctate (punctures for the most part concealed by pubescence) except in basal and apical sulcus. Scutellum subtriangular, sides oblique, rounded into the apex which is sharply arcuate. Elytra strongly covered with tubercles; basal gibbosity quite prominent, bearing a long, pronounced carina and accentuated posteriorly by a deep impression; discal punctation visible only at base; sides planate or slightly convex; apices somewhat acuminate, separately obliquely rounded or sub truncate at suture, the angles not pronounced. Prosternal process slightly more than half as broad as a procoxal cavity; mesosternal process two-thirds as broad as a mesocoxal cavity; fifth sternite about one-third longer than fourth in male, as long as third and fourth combined in female. Legs successively longer posteriorly; femora clavate, pedunculate at base; protarsi with first segment about as long as third, meso- and metatarsi with first segment a little shorter than next two together. Antenna distinctly shorter or feebly longer than body in both sexes; scape scarcely reaching behind middle of pronotum, feebly expanded below at apex; third scarcely longer than first, arcuate; fourth one-seventh shorter than first; fifth one-half or two-thirds as long as first; sixth one-half or less as long as first.

Genotype: Lamia aculifera Say (= *transversus* Gyllanhal), herewith designated.

Remarks: The chief characteristics of this genus are the strongly tuberculate disks of pronotum and elytra, the lateral tubercle of the former placed only very indistinctly behind the middle, the elytral basal gibbosity prominent, the antennal scape rather short, reaching only slightly behind pronotal lateral tubercles, fifth segment one-half or two-thirds length of first, and sixth segment less than half as long as first. In addition, the shape of the front, the characters of the pro- and mesosternal processes, and the length of first tarsal segment are diagnostic.

KEY TO SPECIES

1. Metatrochanter not at all prolonged apically; pubescence of upper surface brownish or dull ashy 2
   Metatrochanter in both sexes prolonged into a short, acute spine apically; pubescence of upper surface whitish; fifth antennal segment nearly two-thirds as long as first . . . . . **albescens**
2. Antennae with fifth segment one-half as long as first; tarsi fuscous, with ashy pubescence on base of first segment . . . . . **transversus**
   Antennae with fifth segment two-thirds as long as first; tarsi yellow-ferrugineous, infuscate on apex of last segment, cinereous pubescent, with fuscous hairs on apex of third and fifth segments . . . . . **vogti**

Leptostylus vogti Dillon, spec. nov.

Male. Olive and bright green, except on front, sutural half of each elytron, undersurface of body, antennal segments five to eleven, and tarsi, which are yellow-ferrugineous; entirely covered with short, brownish cinereous pubescence. Head with front vaguely brownish punctate. Pronotum with discal pubescence a little whiter than the rest, with a short, vague, brown vitta each side on anterior margin, and two similar ones placed further laterad on base. Scutellum im-

maculate. Elytra broadly tinged with pale brown basally and on sutural half to middle, just behind middle with a common, narrow, fuscous arc which connects to a broad, common, brown band, the latter broadly removed from the side margins, the space intervening between the arc and the band whitish pubescent; on sides with a narrow, irregularly undulating, black line placed just on the angle formed with the disk and extending below humerus; anterior margin of humerus without a dark marking; with several tufts along suture in a row, in two or three short series on basal gibbosity, and in three short series at apical fifth (in the fuscous and brown markings). Body beneath and legs nearly white pubescent, the latter vaguely dark mottled; femora without distinct maculae or annulae; tibiae with two subequal, fuscous maculae anteriorly, one at basal two-fifths, the other at apical fourth; tarsi with last segment infuscate apically, whitish pubescent, the third and last segments with sparse, fuscous pubescence apically. Antennae whitish pubescent, with sparse, coarse mottling, the apices of segments two to eleven and bases of segments six to eleven, fuscous annulate.

Head as in *tuberculatus* but the usual median impression above the antennal tubercles extends down onto front well between the eyes; eyes with lower lobe transverse, three-fourths as tall as gena. Pronotum with lateral tubercles subobsolete; disk finely, sparsely punctate, with five large tubercles, median line elevated on apical third. Elytra with a strongly prominent basal gibbosity, followed posteriorly by a large, rounded, deep impression; disk with six costae which are not especially prominent, with tubercles only at base, but with scattered fascicles; surface coarsely punctate basally and on sutural half of disk, on the outer half covered with large, quadrate, subfoveate impressions which are about as wide as the upper lobe of eye; apex narrowly truncate. Prosternal process a little more than one-half as broad as a procoxal cavity; mesosternal process two-thirds as broad as a mesocoxal cavity; fifth sternite slightly longer than fourth. Metatrochanter not spinose. Antennae feebly longer than body; not fringed beneath; scape extending to middle of pronotum; third segment subequal to first; fourth slightly shorter, fifth one-third shorter than first and sixth one-half as long as first, rest gradually diminishing in length.

Length 7.8 mm.; width 4 mm.

Holotype: Male; S. W. Hidalgo Co., Tex., emerged April 1, 1947 from fruit of *Sapindus drummondii* H&A, collected Jan. 19, 1947; (Geo. B. Vogt) [CAS].

Remarks: Resembles *tuberculatus* in having tufts of hair on the elytra and in lacking a metatrochanteral spine, but is distinct in having much of the body surface green. The elytra have subfoveate impressions on their entire lateral halves and there is an impression extending between antennal tubercles and onto the front. Moreover, the antennae are longer than the body, the fifth segment being two-thirds as long as the first, while the third is only equal to the latter. These same characteristics will distinguish this form from the somewhat similar appearing *L. gibbulosus* Bates of South America.

Leptostylus transversus transversus Gyllenhal

Cerambyx tuberculatus Froelich, 1792, Naturforscher, 26: 138 [non Degeer, 1775].
Leptostylus tuberculatus (Froelich). Knull, 1946, Bull. Ohio Biol. Surv., 39: 245, f. 78 [new syn.].
Lamia transversa Gyllenhal, *in* Schoenheer, 1817, Synon. Ins. I, 3, append. p. 164.
Lamia aculifera Say, 1824, Jour. Acad. Nat Sci. Philadelphia, 3: 329.
Amniscus aculiferus (Say). Haldeman, 1847, Trans. Amer. Philos. Soc. 10: 47.
Leptostylus aculiferus (Say). LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia, (2)2: 168. Horn. 1880, Trans. Amer. Ent. Soc. 8: 121. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 23: 117. Blatchley, 1910, Col. Ind., p. 1073, fig. Champlain, Kirk, and Knull, 1925, Ent. News, 26: 140.
Amniscus marginellus Haldeman, 1847, Trans. Amer. Philos. Soc. 10: 47.

Male. Ferrugineous to piceous, densely dull ashy pubescent, pubescence sometimes light fulvous, rarely snowy white, clouded with brownish to a greater or lesser extent and mottled with brown on head, body beneath, legs, and first four segments of antennae. Front heavily clouded with brown; genae with a small black macula behind eye; vertex with a short streak each side of middle and a minute median macula anterior to these, of fuscous. Pronotum with a median line finely glabrous, widened on posterior tubercle and sometimes fuscous pubescent there on apical margin at middle of each side a short, fuscous streak and, a little more laterad, a similar set of markings on basal margin, these streaks are often wanting in whole or part; sides broadly metallic green and mottled with fuscous. Scutellum largely fuscous, often ashy medially. Elytra with a small, triangular, fuscous spot at scutellum, at basal sixth a transverse row of two or three small fuscous spots, entire apical third brown-fulvous pubescent (often interspersed with ashy),bordered anteriorly at suture with a large blackish spot and beyond middle of disk extending abruptly obliquely forward to sides; anterior to this area is a faint, oblique, ashy or whitish band, which usually is wanting or dispersed on the epipleuron; at apical two-fifths near (but not attaining) suture is a short, oblique, fuscous line; along suture but removed from it a vitta of metallic green on basal two-thirds; on side metallic green from beneath humerus nearly to apex, feebly interrupted sometimes by the whitish band at apical third but never entirely so, from anterior margin of humerus to middle a broad vitta of fuscous running above the green, often extending onto disk at middle of elytron and sometimes green-reflexed. Body beneath blackish medially,

ashy pubescent on sides, pubescence rarely tinged with fulvous. Legs ashy pubescent; femora black-annulate beyond middle; tibiae narrowly annulate at basal third, broadly so at apex, at the latter position annulus is intermingled with ashy. Antennae fuscous-annulate on apices of all segments.

Entire upper surface densely alutaceous and minutely punctulate. Head with one or two setigerous punctures near eye on vertex, on sides of front, and below eye on gena; front widest directly below eye, one-half again as broad as high; eyes with lower lobe usually transverse, shorter than gena by one-third. Pronotum broadest near middle, sides subparallel, with a small but prominent tubercle that occupies about one-third their length; disk impunctate except for several irregular series of fine punctures across base and at apex, the latter often wanting, and usually with one or two setigerous punctures near lateral tubercles, with five strongly elevated, large tubercles, each larger than the lateral ones, placed two before and three behind, and median line elevated distinctly on apical third. Elytral surface very irregular, with six costae, each bearing distinct tubercles; basal gibbosity very prominent, bordered posteriorly by a deep, broad sulcus; disk with scattered very fine punctures; apices somewhat prolonged, feebly obliquely or squarely truncate, the angles never prominent. Prosternal process one-half (or a little more than half) as broad as a procoxal cavity; mesosternal process two-thirds as broad as a mesocoxal cavity; fifth sternite one-third longer than fourth, rounded at apex. Metatrochanter not spinose; antennae reaching only to middle of apical patch; scape extending to middle of pronotum, strongly deflexed at apex; third segment slightly longer than first; fourth one-seventh shorter than first; fifth one-half as long as first; sixth strongly shorter than fifth, rest gradually decreasing.

Female. As male but fifth sternite as long as third and fourth together.

Length 7.5–9 mm.; width 3–5 mm.

Type localities: Virginia [*tuberculatus*]; Missouri [*aculiferus*]; North America [*marginellus; transversus*].

Distribution: From southeastern Canada to Maryland west to Minnesota and Missouri [see remarks]. New York: 2, Olcott, June–July, 1926 (Dietrich) [CU]; 1, Ithaca, April [CU]. Ontario: 1, Pt. Pelée [CU]. New Jersey: 1, Milltown, April 20 [AMNH]. Maryland: 1, Baltimore, December 29, 1918 [CU]. Ohio: 1, Cavallo, May 27 [Miami]; 1, Gambier, October 2 [Miami]; 1, Knox Co., September 20 (H. F. Strohecker) [Miami]. Indiana: 1, no further data [KU]; 1, Putnam Co. (WSB) [TAM]; 1, Lawrence Co. [TAM]. Illinois: 1, no further data [Minn.]; 1, Moline [Minn.]; 2, Galena, May–June [AMNH]. Wisconsin: 1, no further data [Minn.]. Minnesota: 7, Olmstead Co. [Minn.]; 1, Excelsior [Minn.]; 1, Houston Co. [Minn.]; 2, Hennepin Co.; [Minn.]. Missouri: 4, no further data [Minn.]; 1, New Franklin [CU].

Remarks: Specimens from Minnesota and Missouri are intermediate between the typical eastern form and *dakotensis;* examples from the latter state in addition show characters of *dietrichi* as well. Since this state is the type locality of *aculiferus*, the name could be applied equally well to all three forms, but it was believed best to treat it as an absolute synonym of *tuberculatus* to avoid ambiguity in the future.

Notwithstanding remarks in the literature to the contrary, neither sex in this species (or any of its subspecies) has the metatrochanter prolonged into a spine or tooth.

Leptostylus transversus dakotensis Dillon, subspec. nov.

Antennae and eyes as in the nymotypic form; differs chiefly in the nearly uniform gray-brown pubescence covering entire body, the apical third of elytra being only a little darker; sides of pronotum and elytra nearly lacking green pubescence, being replaced by brown, darker brown than disk but not fuscous, except for a series of small dots and before humerus; elytral pale fascia at apical third indistinct.

Holotype: Male; Elk Point, S. Dakota [Minn].

Allotype: Female; Nebraska [Minn.].

Paratypes: 2, Sioux City, Iowa [Minn.]; 8, Douglas Co., Kansas [KU]; 5, Lawrence, Kansas [KU]; 1, Aulue, Kansas, June [KU]; 1, Genoa, Nebraska [KU].

Leptostylus transversus asperatus (Haldeman)

Amniscus albescens var. *asperatus* Haldeman, 1847, Trans. Amer. Philos. Soc., 10: 46.

Leptostylus divisus 1913, Casey, Mem. Col., IV, p. 307 [new syn].

Resembles *dietrichi* in having antennae as long as body, or a little longer. Lower lobe of eyes usually taller than gena, subquadrate. Body covered with whitish pubescence, clouded feebly with brownish, the apical area of elytra pale brownish; without trace of metallic green, except sometimes on sides of elytra, which are broadly dark brown and fuscous; post-median macula of elytra wanting or obsolete, the pale fascia at apical third indistinct, not attaining lateral margins. Body beneath and legs often pale fulvous pubescent in part.

Type localities: United States [*asperatus*]; Texas [*divisus*].

Distribution: Texas, probably confined to the central portion. Texas: 10, no further data [Minn.; CAS; CU]; 1, Goldthwaite, September 21, 1935 [TAM]; 1, Mexia, September, 1937 [TAM]; 5, Cypress Mill [TAM; CAS]; 2, Comal Co. [AMNH]; 1, Round Mt. [CAS].

Remarks: The Mexia specimen is an intergrade with *dietrichi*.

Leptostylus transversus dietrichi Dillon, subspec. nov.

Resembles the nymotype closely but the elytra in general much darker in color and have the pale band at apical third narrower, more sharply defined, and extending distinctly to lateral margin. Other differences are as follows: Antennae longer than body in both sexes, the tenth segment attaining elytral apex, eye with lower lobe subequal to gena in height. Pronotum pale dull tawny or, rarely, dingy ashy pubescent with the central dark markings usually more pronounced but generally without a dark macula on the anterior discal tubercles; pubescence across base and sides bright green reflexed. Elytra almost entirely tinged with metallic green (especially so along suture), including the apical dark area, and the dark postmedian macula, which is broader and coalescent at the suture; discal tubercles feebly marked with ochraceous or tawny. Legs, scape, and sides of sternum and abdomen pale fulvous or ochraceous as a rule; rest of antennae ashy and dark pubescent.

Holotype: Male; Lucedale, Mississippi, August 22, 1931 (H. Dietrich) [CU].

Allotype: Female; same data as male but July 13, 1929 [CU].

Paratypes: 3, topotypic [CU]; 1, Hattiesburg, Miss., January 26 [AMNH]; 2, Agriculture College, Miss.: [CU]; 2, Hope, Arkansas, June 13 (L. Knobel) [CU]; 1, New Orleans, Louisiana [KU]; 4, S. W. Arkansas [AMNH]; 1, Tyler, Texas, September 24, 1937 [TAM]; 4, Henderson, Kentucky, Oct. 20, 1941 (J. W. Green) [CAS]; 2, Huntsville, Texas [author's collection].

Remarks: Named for Dr. Henry Dietrich, of Cornell University, who collected several of the paratypes, and who has aided the writer in numerous ways, on innumerable occasions.

The specimen from Tyler, Texas, appears to intergrade with *asperatus* in many ways, whereas the Kentuckian examples begin to approach the nymotype.

Leptostylus transversus floridellus Dillon subspec. nov

Very close to *dietrichi*, which it especially resembles in having the elytral pale fascia at apical third narrow and attaining the lateral margins. In this subspecies, however, the fascia is quite white, not ashy. Moreover, the pubescence of the pronotum is usually bright fulvous, not green at base, and only rarely so on sides. The elytra are bright brown or dark brown pubescent, with very little metallic green reflex typically, and with four distinct fulvous vittae on each disk; the sides are generally paler, too, than in that form and are not green reflexed as a rule. The abdomen beneath is not so glabrous medially as in *dietrichi*.

Holotype: Male; Biscayne Bay, Florida [AMNH].

Allotype: Female; Lake Worth, Florida [AMNH].

Paratypes, all Florida: 1, Dunedin [CU]; 1, Florida, September 20, 1895 [CU]; 1, Fort Capron [Minn.]; 1, Sarasota [CU]; 1, Orange Grove [AMNH]; 1, Indian River [AMNH]; 1, Kissimee [AMNH]; 1, Key West [AMNH]; 4, Dade Co., May 31, June [Miami]; 1, Cape Sable, May, 1948 [Miami]; 1, Ocala [CAS].

Remarks: The specimens from the more northern part of the State seem to intergrade with *dietrichi*.

Leptostylus albescens (Haldeman)

Amniscus albescens Haldeman, 1847, Trans, Amer. Philos. Soc., 10: 46.

Leptostylus albescens (Haldeman). Casey, 1913, Mem. Col., IV, p. 307.

Extremely close to *L. tuberculatus* in structure and coloration; differing only as follows: Pubescence uniformly and constantly ashy-white, on elytral tubercles sprinkled indistinctly with luteous or white. Elytra on apical fourth usually marked with two bands, rarely partially coalescent, the anterior one outlined before by several black streaks, the postmedian sutural spot usually distinct; the blackish area on sides strongly intermixed, as a rule, with metallic green pubescence. Pronotum laterally faintly tinged with green. Antennae feebly longer than body in both sexes. Elytral tubercles less strongly elevated. Metatrochanter in both sexes prolonged at apex into an acute, short spine. Antennae with fifth segments about two-thirds as long as first.

Length 8–12 mm.; width 3.7–5 mm.

Type locality: United States of North America.

Distribution: Southeastern United States. District of Columbia: 1, no further data [Minn.]. South Carolina: 3, Florence, June, Oct. [PDES]. Florida: 1, Sanford, May 4, 1908 (Van Duzee) [AMNH]. Alabama: 1, Magazine Pt., Nov. 14, 1910 [KU]; 3, Mobile Co. [KU; CU]. Mississippi: 2, Lucedale, June 23 [CAS; CU]. Texas: 2, Tyler, Aug. 12, 1937 [TAM].

Leptostylopsis Dillon, gen. nov.

Moderate in size, robust, convex. Head with front one-eighth to one-third wider than high, widest at lower angle of eye, strongly narrowed to mouth, feebly so between eyes; eye with lower lobe erect, subequal to gena in height. Pronotum two-thirds again as wide as long, broadest across the lateral tubercles, which are situated at or feebly behind middle; disk with five or seven distinct tubercles which are usually less prominent than the lateral tubercles, sparsely and irregularly punctate, basal and apical sulci containing a row of fine punctures. Elytra devoid of tubercles, basal gibbosity distinct but not promin-

ent, outlined posteriorly by a more or less apparent, broad impression, with four or five usually prominent costae, punctation distinct over entire disk; sides subplanate; apices feebly (or scarcely) acuminate, obliquely truncate or emarginate-truncate to suture, the angles often acute. Prosternal process two-thirds as broad as a procoxal cavity; mesosternal process as broad as (or broader than) a mesocoxal cavity; fifth sternite longer than the fourth in male, much longer in female. Legs posteriorly successively longer; femora clavate, robust, pedunculate at base; protarsi with first segment subequal to third, meso- and metatarsi with first segment a little shorter than next two together. Antennae at least one-fourth longer than body, usually longer in male; scape extending behind middle of pronotum, often strongly so, slightly expanded beneath at apex; third segment feebly shorter than first; fifth one-eighth shorter than first; sixth about two-thirds as long as first; rest gradually decreasing in length.

Genotype: Leptostylus terraecolor Horn.

Remarks: From *Leptostylus*, this genus differs in the less strongly tuberculate pronotal disk, and the longer antennae with the fifth and sixth segments much longer, the latter being about two-thirds as long as first. Furthermore, the shape and breadth of the front are distinctive, and the mesosternal process is broader, exceeding, as a rule, a mesocoxal cavity in width.

KEY TO SPECIES

1. Pronotum with median line elevated and either denuded or black pubescent from base to apex; entire body largely pale ashy pubescent, with luteous maculae; dark macula at apical third of elytral suture directed squarely transverse..... **argentatus**
   Pronotum with median line not entirely elevated nor entirely black; body pubescence yellowish, brown, or dark in whole or in large part; dark macula of elytra not squarely transverse..... 2
2. Pronotum with lateral tubercle prominent, conical, armed at apex; elytra with yellow lines on disk; Texas..... **luteus**
   Pronotum with lateral tubercle only slightly prominent, rounded, unarmed; elytra without yellow lines; Southeastern States..... 3
3. Pronotum with an arcuate patch of densely placed punctures on each side of median tubercle of disk; pubescence of upper surface nearly uniform brown..... **terraecolor**
   Pronotum sparsely punctate on disk, with close punctures only in a row at base and apex; pubescence of upper surface of body never uniform.. **planidorsus**

Leptostylopsis argentatus (Duval)

Leptostylus argentatus Duval, *in* de Sagra, 1857, Hist. Cuba, VII, p. 273. Chevrolat, 1862, Ann. Soc. Ent. France, (4)2: 247. Horn, 1880, Trans. Amer. Ent. Soc., 8: 121. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 23: 117.

Leptostylus taeniatus Casey, 1913, Mem. Col., IV, p. 306 [new syn.].

Male. Dark reddish brown, densely covered with ashy or silvery white pubescence. Head finely mottled with fuscous and with a short, arcuate, fuscous streak mesially at base of antennal tubercles; behind eye on gena a small, black macula and another fuscous one each side of middle of vertex. Pronotum with a narrow median line glabrous or fuscous pubescent and usually with a short, fine, fuscous streak each side of middle extending from apical margin. Elytra fuscous in a common, small, quadrate patch around scutellum, and usually well sprinkled with numerous yellow maculae (placed on the tubercles); much of apical third and two maculae on each side (one smaller, just behind humerus, the other rather large, at middle) of brown pubescence; along suture and laterally with a number of fuscous points; just before apical third of suture an L-shaped fuscous macula which is directed squarely across the disk. Body beneath rather heavily mottled and clouded with brown. Legs and antennae heavily mottled with brownish; femora broadly before middle, and tibiae usually narrowly at basal third and broadly at apex, annulate with fuscous; last two segments of tarsi fuscous; antennae with all segments fuscous annulate apically.

Entire upper surface minutely, densely alutaceous. Head with three setigerous punctures each side of vertex near eye and two on gena below eye, rest impunctate; front one-eighth wider than high, widest just below eye, thence constricted and reëxpanded to mouth, also somewhat narrowed between eyes; eyes with lower lobe feebly erect, not quite so tall as gena. Pronotum behind middle, two-thirds again as wide as long, sides feebly narrowing from base to near apex where it is narrowly constricted; lateral tubercles broad, obtuse, prominent; disk with fine punctures more or less arranged in lines or rings, one line in apical sulcus and another of coarser punctures in basal sulcus, with four prominent but small tubercles in a row apically and three larger ones posteriorly. Elytra each with six obsolete costae bearing rather close-set, small, but prominent, tubercles; basal gibbosity broad, oblique, rather low, defined posteriorly by a broad, rather deep depression; entire surface finely and rather densely punctate; apex usually slightly prolonged, obliquely emarginately-truncate, the angles sometimes subdentiform. Prosternal process two-thirds as broad as a procoxal cavity; mesosternal process one-ninth wider than a mesocoxal cavity, its anterior margin abruptly vertical; fifth sternite scarcely longer than fourth; at apex broadly truncate. Legs successively longer posteriorly; femora moderately clavate, rather robust; protarsi much more robust than others, with first segment nearly as long as next two together. Antennae longer than the body by one-half, sixth segment attaining elytral apex; scape slender, not prominent at apex; attaining basal fifth of pronotum; third feebly longer than scape; fourth very nearly as long as first; fifth

three-fourths as long as fourth; rest gradually shorter.

Female. As male but fifth sternite as long as third and fourth together, its apex deeply emarginate.

Length 7–12 mm.; width 3–4.5 mm.

Type localities: Cuba [*argentatus*]; Lake Worth, Florida [*taeniatus*].

Distribution: Cuba and Southern Florida. Florida: 3, no further data [CU]; 1, Paradise Key, April 10, 1921 (J. N. Knull) [Minn.]; 1, Lake Worth [AMNH]; 1, Kissimee [AMNH]; 1, Marco, April 19 [AMNH]; 1, Biscay Bay [AMNH].

Leptostylopsis terraecolor (Horn)

Leptostylus terraecolor Horn, 1880, Trans. Amer. Ent. Soc., 8: 121, 122. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc., 23: 118.

Leptostyus transversatus Chevrolat. LeConte, 1878, Proc. Amer. Philos. Soc., 17: 414 [misdet.].

Leptostylus mutilus Casey, 1913, Mem. Col., IV, p. 307. [new syn.].

Fuscous or dark yellowish brown, densely covered with pubescence that is very variable in color, ranging from luteous or ochraceous to ashy or to dull grayish brown. Head, body beneath, legs, and antennae finely mottled with brownish, the first also with a small, black macula on gena behind eye. Pronotum clouded vaguely with brownish gray laterally, and with a large, poorly defined, darker macula each side of middle partially encircling the median tubercle; on apical margin two, and on basal margin three, small fuscous marks. Elytra with a common, more or less semicircular patch of fuscous around scutellum; disk broadly, irregularly clouded with brownish gray to a greater or lesser degree, the tubercles often luteous or bright ochraceous; at apical two-fifths of suture a short line or narrow fascia of fuscous which extends at an angle of about 75° anteriorly to middle of disk, often broken into maculae, and at apical fourth near middle of disk a moderately small, fuscous macula with a smaller one placed obliquely behind it laterally; frequently a third fuscous macula occurs near apex and quite often there is a large, oblique, fuscous macula behind basal gibbosity; on sides anterior to humerus there is a broad, subquadrate, fuscous macula. Tibiae broadly annulate at basal fourth and at apex with fuscous; tarsi with third segment fuscous, claw segment sometimes fuscous, but more usually ashy pubescent, at least on basal half. Antennae with all segments fuscous annulate.

Entire upper surface finely, densely alutaceous. Head on vertex with several, usually setigerous punctures, one or two similar punctures on sides of front and on gena below eye; front one-third again as wide as long, widest at lower angle of eye, thence strongly narrowed to mouth, also distinctly narrowed above; eyes with lower lobe not quite so tall as gena, feebly erect. Pronotum widest just behind middle, two-thirds broader than long, sides parallel at base and apex, lateral tubercles broad and rounded, rarely subangulate at its apex, usually more in the form of a tumescence than that of a typical tubercle; disk with a row of four tubercles across apical third, the two lateral ones often feeble, and a row of three behind middle, entire surface with scattered coarse punctures, a dense lunate patch of these punctures around each side of the median tubercle and a row at apex and at base. Elytra often a little less coarsely punctate than pronotum and uniformly, rather sparsely so; disk each with the six costae obsolete, indicated chiefly by the low tubercles; basal gibbosities distinct, outlined posteriorly by an oblique, broad depression, bearing two prominent ridges at base and a single distinct tubercle apically near suture; apices feebly prolonged, obliquely truncate (often emarginately so) to suture, the angles sometimes only feebly pronounced. Prosternal process two-thirds as broad as a procoxal cavity; mesosternal process distinctly broader than a mesocoxal cavity; fifth sternite a very little longer than fourth. Legs successively longer posteriorly; tarsi as in *argentatus*. Antennae three-fifths longer than body, sixth segment surpassing elytral apex; scape slender, not prominent at apex, attaining basal fifth of pronotum; third segment feebly longer than first; fourth one-seventh shorter than third; fifth one-eighth shorter than fourth, three-fourths as long as third; rest successively very feebly shorter.

Female. Fifth sternite nearly as long as the two preceding together; and antennae only one-half again as long as body, the seventh segment attaining elytral apex.

Length 7–10 mm.; width 3.1–4.5 mm.

Type localities: Florida [*terraecolor*]; Key Largo, Florida [*mutilus*].

Distribution: Southern Florida. Florida: 5, no further data [CU; KU]; 4, Key Largo, May [CU]; 2, Key West [KU; AMNH]; 1, Parker Is., Highland Co., December 25, 1945 [CU]; 1, Royal Palm Park, April 1, 1925 (W. S. Blatchley) [CU]; 2, Biscayne, Minn. [AMNH]; 4, Enterprise [AMNH]; 1, Lake Okeechobee, October 2 [AMNH]; 1, Kissimee [AMNH]; 1, Everglade [AMNH]; 1, Marco [AMNH]; 1, Biscay Bay [AMNH]; 1, Port Sewall [AMNH]; 1, Ft. Lauderdale, Apr. 6, 1947 (J. W. Green) [CAS].

Host plants: Recorded as breeding in *Sideroxylon pallidum* (Mastich) and in the so-called rubber tree (*Ficus pedunculatus*).

Remarks: The broad semicircular or lunular patch of coarse punctures is the best identifying mark of this form, as well as its nearly uniform brown coloration. In describing *mutilus*, Casey fails to mention this characteristic punctation, but otherwise his description applies to specimens of this species before the present writer.

Leptostylopsis planidorsus (LeConte)

Leptostylus planidorsus LeConte, 1873, Smith. Misc. Coll., 264, p. 234. Horn, 1880, Trans. Amer. Ent. Soc., 8: 121. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 23: 118.

Leptostylus lecontei Casey, Mem. Col., IV, 1913, p. 305 [new syn.].

Leptostylus crescenticus Casey, Mem. Col., IV, 1913, p. 306 [new syn.].

Female: Dark reddish brown or dark ferrugineous, covered densely with ashy gray pubescence, the head, the body beneath, legs, and antennae mottled with fuscous. Front clouded with brownish gray; gena behind with a small, blackish macula. Pronotum often vaguely clouded with brown-fulvous on disk; on sides at base a large, black blotch and a small, dark macula near apex; disk with a semicircle of four black maculae apically and three similar small maculae along basal margin, the median one of which sometimes is prolonged to middle of disk. Scutellum irregularly black maculate. Elytra with a broad, black patch each side, between the pair of patches the disk is brown to a greater or lesser extent, with an area of ashy gray pubescence before and behind this; disk often with several rows of black points; from just behind middle of suture a multiangulate black line extends obliquely posteriorly three-fourths across disk, behind this beginning one-third across disk from suture is a broader macular band reaching to sides; this entire apical portion is often tinged with brown; sides before and below humerus black. Femora broadly at middle and tibiae at basal third and on entire apical third, black annulate; tarsi entirely blackish. Antennae with all segments narrowly black annulate.

Entire upper surface minutely alutaceous. Head on vertex with a few setigerous punctures, and one each side of front and another on gena beneath eye; front one-fourth again as wide as long, widest at lower angle of eye, thence strongly narrowed to mouth and also narrowed above; eyes with lower lobe slightly erect, a little taller than gena. Pronotum widest just behind middle, two-thirds wider than long, sides subparallel at base and apex, lateral tubercle moderate in size, smaller and less prominent than in *terraecolor;* disk very sparsely and quite finely punctate, some fine punctures arranged in rows in basal and apical sulci, apically with two tubercles at middle, at basal third with a row of three tubercles, the two more lateral ones rather feeble. Elytra rather finely and sparsely punctate, the punctures coarse and denser in the lateral black patch, each with six costae visible apically, the median discal one distinct to base, all bearing small tubercles, irregularly spaced; basal gibbosity fairly pronounced, defined by an oblique impression posteriorly; apices rather feebly obliquely, narrowly truncate at suture, the outer angle somewhat acute. Prosternal process two-thirds as broad as a procoxal cavity; mesosternal process no broader than a mesocoxal cavity; fifth sternite one-half again as long as fourth. Tarsi as in *argentatus.* Antennae two-fifths longer than body, seventh segment attaining elytral apex; scape extending to basal fifth of pronotum, slender; third segment as long as scape; fourth one-seventh shorter; fifth one-sixth shorter than fourth, rest gradually decreasing.

Male. As female but femora more robust; fifth sternite only feebly longer than fourth; and metatrochanters produced posteriorly into a short, acute spine.

Length 8.5–10.5 mm.; width 3.8–4.2 mm.

Type localities: Louisiana [*planidorsus*]; Lake Worth, Florida [*lecontei*]; Crescent City, Florida [*crescenticus*].

Distribution: Southeastern States. Maryland: 1, no further data [Minn.]. South Carolina: 1, Florence, June 22, 1953 [PDES]. Georgia: 2, Savannah [KU; AMNH]. Florida: 3, Ft. Mead, August 13, 1930 (J. Nottingham) [KU]; 1, Wakulla, June 29, 1948 [KU]; 1, La Belle [KU]; 2, Royal Palm Park, July 22, 1948 (R. H. Beamer) [KU]; 1, Enterprise [KU]; 2, Kissimee [AMNH]. Mississippi: 1, Lucedale, June 18, 1931 (Dietrich) [CU]. Louisiana: 1, Vowell's Mill, August [AMNH].

Remarks: In certain points of maculation this species recalls the members of the genus *Stylolep-tus,* having, like them, black maculae on the sides of pronotum and the tarsi entirely blackish. However, on a structural basis, it belongs here. In coloration, this is one of the most variable species of this highly variable tribe.

Leptostylopsis luteus Dillon, spec. nov.

Female. Dark reddish brown, densely covered with ashy pubescence, lightly clouded with brown on head above, on pronotal disk, and on sides of elytra, especially near apex, and faintly tinged with luteous on head and pronotum. Elytra each with four distinct luteous lines interrupted by many long tufts of fuscous hairs, one of which tufts, forms an elongate crest on basal gibbosity; at apex a rather large luteous patch, the anterior margin of which is strongly oblique, ascending to the suture, bordered by an indistinct brown fascia which becomes fuscous at the suture, this fascia in turn margined anteriorly by an interrupted bright ashy fascia; on deflexed sides at basal fourth a distinct, rather large, fuscous macula. Body beneath, legs, and antennae dark ferrugineous, sparsely ashy pubescent; femora and first six antennal segments mottled with reddish brown, the former broadly blackish at base; tibiae broadly fuscous-annulate on apical third; tarsi fuscous, the first segment ashy-annulate at base; apices of antennal segments beginning with second broadly fuscous-annulate, the sixth and following narrowly annulate on base as well.

Head slightly impressed behind antennal tuber-

cles, impunctate; front one-fourth again as wide as high, strongly narrowed between eyes, slightly so below, somewhat convex; eyes with lower lobe one-fourth shorter than gena, slightly transverse, upper lobe one-fourth shorter than gena, slightly transverse, upper lobe one-third as broad as interocular space. Pronotum nearly three-fourths again as broad across lateral tubercles as long, sides gradually tapering to apex which is narrower than base; lateral tubercles rather small, but prominent, armed with a robust, obtuse tooth; disk with five tubercles, the two lateralmost feeble, rest prominent, the anterior pair broad, surface finely, indistinctly punctate, with a row of coarse punctures in basal sulcus. Elytra rather coarsely, densely punctate; each disk with four distinct costae which bear small but pronounced, tufted tubercles; basal gibbosity feebly elevated, at apex bearing an elongate, low crest; apices separately, narrowly rounded, obliquely subtruncate at suture, the outer angle briefly dentate. Metafemora distinctly slenderer than mesofemora. Fifth sternite half again as long as fourth. Antennae one and two-fifth times as long as body, beneath with only one or two fringing hairs near apex of scape; scape slightly surpassing middle of pronotum; third segment one-fourth again as long as first; fourth feebly longer than first; rest distinctly diminishing in length.

Length 6.4 mm.; width 2.6 mm.

Holotype: Female; Esper Ranch, Brownsville, Texas (Mont Cazier) [AMNH].

Remarks: From the other members of the genus this species is distinct in its small size and especially in having the lateral tubercle of the pronotum quite prominent and provided with a tooth. The yellow coloration of the elytral pubescence is also diagnostic.

Trichastylopsis Dillon, gen. nov.

Moderate-sized, cylindrical beetles. Head densely punctulate on front and genae; front less than one-sixth again as broad as long, broadest slightly below eye, narrowed subequally to mouth and between eyes; eyes separated above by a little more than the width of an upper lobe, lower lobe subquadrate, slightly exceeding gena in height. Pronotum subcylindrical, three-fifths wider than long, lateral tubercles situated near basal two-fifths, broad, low, subobtusely angulated; disk distinctly, rather uniformly punctate at least medially, with an elongate, obliquely transverse, prominent tubercle each side of middle close to apical margin, sometimes with a feeble, median, subbasal tubercle as well; transverse sulci not well defined, being more or less continuous with disk. Elytra each with four feeble costae, interrupted by tufted tubercles; basal gibbosities rather prominent, bearing two large, tufted crests; punctures distinct to apex; apices separately rounded or broadly obliquely truncate at suture, the angles not produced. Prosternal process two-thirds as wide as a procoxal cavity, briefly but distinctly angularly expanded near middle each side; mesosternal process nearly or quite as broad as a mesocoxal cavity, strongly expanded at apex; fifth sternite slightly longer than fourth in male, one-third longer in female. Legs moderate in length, increasing in length successively from front to rear; femora capitate, robust, pedunculate basally; metatarsi with first segment feebly longer than next two together, slightly shorter on meso- and protarsi. Antennae slightly longer than body in both sexes, sparsely fimbriate beneath on the basal four segments; scape reaching slightly behind middle of pronotum, slender, produced beneath at apex; third segment very slightly longer than first; fourth one-tenth, fifth one-third, and sixth one-half, shorter than first; rest gradually diminishing in length.

Genotype: Leptostylus albidus LeConte.

Remarks: The angulated prosternal process is the most outstanding characteristic of this genus, which also is remarkable for the flying hairs on the legs. In addition, the relatively narrow front, pronotal sculpturing, tufted elytra, and antennal formula will serve to distinguish it.

Trichastylopsis albidus (LeConte)

Leptostylus albidus LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia, (2)2: 168.

Leptostylus falli Linsley, 1934, Ent. News, 45: 182 [new syn.].

Male. Fuscous, moderately densely covered with silvery-white or fulvous-ashy pubescence. Head largely tinged with fulvous and indistinctly mottled with brown. Pronotum vaguely tinged with fulvous, but more distinctly so medially; disk medially clouded with brown, and with three dark brown, short vittae or elongate maculae, one at middle basally and one each side of middle on anterior half. Elytra each with four fulvous vittae joining in an oblique line before apex, and humerus and apex with a patch of the same color, the patch on apex extending obliquely posteriorly from behind middle at suture to sides at apical fourth; disk with scattered tufts of hairs, especially near base; on sides behind humerus a large, elliptical, blackish patch extending partially onto disk. Body beneath and legs reddish brown, densely whitish pubescent; femora indistinctly mottled with brown and fulvous; tibiae indistinctly annulated with brownish at apex and at basal third; tarsi variegated vaguely with fulvous; femora apically and tarsi with long, white, flying hairs. Antennae reddish brown, covered with ashy and fulvous pubescence; mottled on basal segments and annulate apically on all segments, with brownish.

Entire upper surface minutely alutaceous. Head with front and genae densely punctulate; eyes with lower lobe subquadrate, slightly exceed-

ing gena in height. Pronotum three-fifths again as wide as long, sides subparallel; lateral tubercle broad, rather low, obtusely angulate; disk finely, rather densely, uniformly punctate, with a prominent tubercle each side of middle just behind apical margin, each extending obliquely nearly to sides, basal half of disk usually planate, sometimes with a feeble indication of a median tubercle. Elytra rather coarsely, densely punctate to apex; basal gibbosity prominent; disk each with three distinct costae, somewhat interrupted, especially at base, by tubercles (bearing tufts of hair); apices separately rounded or broadly, obliquely truncate at suture. Prosternal process angularly expanded each side into procoxa, two-thirds as wide as a procoxal cavity; mesosternal process not quite so broad as a mesocoxal cavity; fifth sternite scarcely longer than fourth. Antennae with eighth segment attaining elytral apex, very sparsely fimbriate beneath on first four segments; scape reaching almost to the lateral pronotal tubercles, slender, produced beneath at apex; third segment very slightly longer than first; fourth one-tenth shorter than first; fifth two-thirds, and sixth one-half, as long as first; rest gradually shorter.

Female. As male but femora less robust; fifth sternite more constricted laterally and one-third longer than fourth; and antennae with ninth segment attaining elytral apex.

Length 8-10 mm.; width 3.2–4 mm.

Type localities: "Junction of Colorado and Gila", Arizona [*albidus*]; Carr Canyon, Huachuca Mts., Arizona [*falli*].

Distribution: Arizona and New Mexico. Arizona: 4, Carr Canyon, June 6, 1930, June 23, 1932 (E. G. Linsley) [CAS]; 3, Carr Canyon, June 27, 1932 (E. G. Linsley) [CU; CAS—paratype of *falli*]; 2, Patagonia, June 9, 1930 (E. G. Linsley) [CAS]. New Mexico: 1; no further data [KU].

Remarks: The characters given by Linsley for distinguishing *falli* from *albidus* are invalid in the specimens examined; the pubescence of the upper surface varies from silvery white to dull fulvous-ashy.

Astylidius Casey

Astylidius Casey, 1913, Mem. Col., IV, p. 308. Knull, 1946, Bull. Ohio Biol. Surv., 39: 247.

Small, rather robust, subconvex beetles. Head with front widest very slightly below eye, rather strongly narrowed to mouth and less strongly so between eyes, two-fifths again as wide as tall; eyes with lower lobe distinctly shorter than gena, suberect or transverse. Pronotum convex, one and one-half to nearly twice as broad as long, sides constricted basally, gradually narrowed apically; lateral tubercles placed at or behind basal two-fifths, prominent, subacute; disk with three large, obtuse tubercles, two anteriorly, one just behind middle, very finely punctate, with coarser punctures in basal sulcus. Scutellum subtriangular or nearly semicircular. Elytra subplanate, with basal gibbosity prominent, subcristate or carinate at apex; disk distinctly punctate and with several distinct costae which bear tufted tubercles at irregular intervals; apices separately rounded, subtruncate, or acuminate and subacute. Prosternal process about one-half as broad as a procoxal cavity; mesosternal process subquadrate or transverse, as broad or broader than a mesocoxal cavity; fifth sternite in male scarcely longer than fourth, in female one and one-half times as long. Antennae one-half or more again as long as body, not fringed beneath; scape slender, not produced at apex, reaching to basal two-fifths of pronotum; third segment one-seventh or more again as long as first, arcuate; fourth subequal to first; fifth two-thirds or four-fifths as long as first; sixth and following gradually shorter.

Genotype: Leptostylus parvus LeConte, by original designation.

Remarks: This genus superficially approaches *Leiopus*, resembling it in the form and position of the lateral spines on the pronotum and in having a strongly convex front. The latter is, however, not quite so convex as in *Leiopus* and, furthermore, the pronotal disk bears three prominent tubercles, the elytral basal gibbosity has a small crest, and, most important of all, the prosternal process is much broader. In actual structure, it more closely approximates *Leptostylus* (in the restricted sense), but has longer antennae and the pronotal lateral tubercles are placed well behind the middle.

KEY TO SPECIES

Pronotum one-half again as broad as long; elytral apices separately rounded or subtruncate; antennae one-half again as long as body, third segment one-fifth again as long as first, fifth segment only two-thirds as long as first; Eastern States. . . . . **versutus**

Pronotum three-fourths or more as broad as long; elytral apices subacute, acuminate; antennae two-thirds longer than body, third segment only one-seventh as long as first, fifth segment four-fifths as long as first; Texas. . . . . **parvus**

Astylidius versutus versutus Casey

Leptostylus parvus (LeConte). Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 23: 119 [ex parte].

Astylidius parvus (LeConte). Casey, 1913, Mem. Col., IV, p. 308. Champlain, Kirk, and Knull, 1925, Ent. News, 36: 140. Knull, 1946, Bull. Ohio Biol. Surv., 39: 247, f. 90. [misdet.]

Astylidius versutus Casey, 1913, Mem. Col., IV, p. 308.

Male. Testaceous to reddish brown, elytra, femora, and other parts often more or less olive-green, covered with sparse whitish or green and ashy variegated pubescence. Head, sterna, and antennae mottled with brown. Pronotum whitish on extreme sides, clouded with fulvous or light brownish on disk; on each anterior discal tubercle a large fuscous macula and another smaller one above lateral tubercles. Elytra with apical two-fifths darker than anterior portion, the darker

area of each elytron delimited anteriorly by a U-shaped brown fascia, which is often absent or vaguely defined; this band in turn is outlined anteriorly by a sinuous white line, often reduced to a short streak; a similar white streak often found at apical sixth and a broader one at basal sixth behind humeri; frequently near middle of each disk there are two poorly defined fulvous vittae; tubercles fulvous pubescent; sides behind humerus with a fuscous macula. Body beneath reddish, uniformly and sparsely ashy pubescent. Femora mottled with dull green or brown, the latter on basal half; tibiae narrowly at basal third and broadly just before apex, annulate with dark brown; tarsi fuscous, first segment and base of second cinereous pubescent. Antennae with apices of segments from third annulate with fuscous, the annulation increasing in width on the distal segments.

Head minutely alutaceous and densely, finely punctulate; front two-fifths again as wide as tall, broadest at lower angle of eye; eyes with lower lobe feebly shorter than gena, subquadrate or feebly transverse. Pronotum nearly one-half again as wide as long, sides slightly wider before tubercle than behind it; lateral tubercle broad, prominent, subacute; disk with a few rather coarse punctures medially and in basal sulcus, some very fine ones laterally and in apical sulcus, with three large, obtuse tubercles, two anteriorly and one just behind middle. Elytra rather coarsely and densely, rugosely punctate, the punctures scarcely finer apically; basal gibbosity pronounced, with a short cariniform, tuberculate crest at apex, delimited posteriorly by a tubercle near suture and laterally by a low tuberculate carina; disk with three or four broken costae bearing scattered, acute, tufted tubercles; apices separately rounded, rarely subtruncate at suture. Prosternal process nearly half as broad as a procoxal cavity; mesosternal process subquadrate, as broad as a mesocoxal cavity; fifth sternite scarcely longer than fourth. Antennae about half again as long as body; scape slender, reaching behind pronotal lateral tubercles, parallel-sided at apex; third segment one-fifth longer than first; fourth feebly longer than first; fifth two-thirds and sixth three-fifths, as long as first; rest gradually shorter.

Female. As in male but fifth sternite one and one-half times as long as fourth.

Length 5.5–6.5 mm.; width 2.1–2.3 mm.

Type locality: District of Columbia.

Distribution: South Atlantic States. Maryland: 1, Takoma Park, July 3, 1952 (G. H. Nelson) [GHN]. District of Columbia: 5, no further data [Minn.]. 2, Washington, June and July [KU].

Remarks: The rounded elytral apices and relatively narrow pronotum are distinguishing characteristics. This species has heretofore been known by the name of *parvus*, the more western form.

Astylidius versutus downiei Dillon, subsp. nov.
FIG. 4.

Leptostylus parvus LeConte. Blatchley, 1910, Col. Ind, p. 1072 [misdet.].

Male. Very similar to the type-form but much darker. Integument piceous, except that of elytra and femora which are green; pubescence generally ashy, varied with fuscous. Pronotum on disk clouded with dull brown, the tubercles black. Scutellum largely black. Elytra with tubercles black pubescent. Tibiae black-biannulate.

Length 5–6.5 mm.; width 2–2.8 mm.

Holotype: Male; Tippecanoe Co., Indiana, June 21, 1953 (N. M. Downie) [author's collection].

Allotype: Female; topotypic, July 4, 1953 (N. M. Downie) [NMD].

Paratypes: 2, same data as allotype [NMD]; 1, Parice Co., Indiana, June 25, 1953 [NMD]; 4, Stony Creek Mills, Pennsylvania, July 3–23, on walnut (D. G. Kissinger) [DGK]; 1, Woodland, Delaware [KU].

Remarks: Named for N. M. Downie, of Purdue University, who collected the type series and who has generously permitted the author to retain the holotype in his own collection.

Astylidius parvus (LeConte)

Leptostylus parvus LeConte, 1873, Smiths. Misc. Coll., No. 264, p. 234. Horn, 1880, Trans. Amer. Ent. Soc., 8: 121.

Astylidius leiopinus Casey, 1913, Mem. Col., IV p. 308. [new syn.].

Leptostylus monki Knull, 1936, Ent. News, 47: 106. [new syn.].

Very close to *versutus*, differing from it as follows: Surface color in general brighter, the elytra as a whole more brilliant green. Pronotum on sides less whitish pubescent. Elytra with basal white line extending *as a line* to or near the side margin, whereas in *versutus* it becomes lost in an irregular maze of whitish pubescence; the post median white line coming off the suture at an angle of less than 45°, not generally greater than this as in *versutus;* lateral dark mark behind humerus more prominent, black.

Eye with lower lobe distinctly shorter than gena as a rule, but this is variable. Pronotum at least three-fourths again as wide as long, the lateral tubercles placed a little more posteriorly. Elytra more finely punctate, the punctures at least as fine as those in the pronotal basal sulcus (coarser than these in *versutus*); apices notably acuminate, the extreme tip subacutely angulate. Antennae about two-thirds again as long as body, with third segment at most one-seventh longer than first; fourth feebly longer or equal to first; fifth four-fifths as long as first and sixth only feebly shorter.

Length 5–7 mm.; width 2–3 mm.

Type localities: Western States [*parvus*]; Columbus, Texas [*leiopinus*]; Donna, Texas [*monki*].

Distribution: South Texas to Mississippi.

Texas: 10, Brownsville, May 30 to June 9, 1932 (E. G. Linsley, J. O. Martin) [CAS]; 2, Brownsville, June 8, 1934 (J. N. Knull) [KU]; 1, Donna (J. W. Monk) [TAM]. Mississippi: 1, Lucedale, May 28, 1930 (H. Dietrich) [CU].

Amniscus Haldeman

Amniscus Haldeman, 1847, Trans. Amer. Philos. Soc. (2)10: 46.
Astylopsis Casey, 1913, Mem. Col., IV, p. 309. Knull, 1946, Bull. Ohio Biol. Surv., 39: 245.

Small or moderately small, subdepressed forms, with prothorax nearly cylindrical. Head impunctate above, front densely punctulate, feebly convex (strongly so in *macula*), meeting mouthparts at a slight angle, widest below lower angle of eye, two-fifths to one-half again as broad as high, tapering to mouth and between eyes; eyes separated above by one and one-half to three times the width of an upper lobe, lower lobe suberect, shorter than gena. Pronotum only subcylindrical, sides subparallel, widest just behind middle, three-fourths again as wide as long (only one-half again in *collaris* and *macula*), lateral tubercle small, variable in prominence but exceeding median discal tubercle in this respect; disk entirely distinctly punctate, with five tubercles, the central one scarcely more prominent than others. Elytra distinctly punctate to apices, usually with prominent costae, and sometime tuberculate or tufted; apices feebly prolonged, varying from separately rounded to obliquely truncate or emarginate at suture. Prosternal process usually at least one-half (sometimes one-third) as broad as a procoxal cavity; mesosternal process at narrowest point four-fifths as broad as a mesocoxal cavity, expanded apically; fifth sternite in male scarcely longer than fourth, in female as long as third and fourth combined. Legs with hinder pairs successively longer; femora clavate, strongly pedunculate at base, tibiae slender; tarsi with first segment of protarsi about one-half longer than third, on mesotarsi and metatarsi longer than next two together. Antennae slightly longer than body in female, about one-fifth longer in male; scape reaching to behind lateral tubercle, prominent at apex on ventral side; third segment at least feebly shorter than first; fourth one-seventh shorter than first; fifth about two-thirds, and sixth one-half, as long as first; rest gradually diminishing.

Genotype: Lamia macula Say, herewith designated [*Amniscus*]; *Lamia macula* Say, by original designation [*Astylopsis*].

Remarks: The distinct dense punctures covering the entire disc of the pronotum is a characteristic that will serve to distinguish the members of this genus from all but its close ally, *Pseudastylopsis*. To this character may be added the subcylindrical form of the pronotum, the shape of the front, the tuberculation of the disc and sides of the pronotum, the wide prosternal process, and the antennal formula as diagnostic structures.

This appeared to be the most fitting disposition of Haldeman's broadly inclusive, but valid, genus. Hence, Bates' (1863) genus of the same name must be replaced by its synonym *Alcathous* Thomson.

KEY TO SPECIES

1. Elytra with scattered tufts of fuscous hairs..... 2
   Elytra without any tufts of hairs..... 3
2. Elytra on sides with a blackish vitta, extending from humerus nearly to apex.....**arcuatus**
   Elytra not vittate laterally.....**sexguttatus**
3. Elytra with a sharply defined white fascia behind middle; abdomen beneath broadly glabrous or or dark pubescent medially, sides ashy.....**macula**
   Elytra rarely with a white fascia, never sharply defined; abdomen entirely uniformly ashy pubescent 4
4. Elytra sprinkled with fine blackish maculae, the darker area extending from suture obliquely forward toward side.....**collaris**
   Elytra without fine blackish maculae, the apical darker area extending from suture obliquely posteriorly toward sides.....**perplexus**

Amniscus collaris Haldeman

Amniscus collaris Haldeman, 1847, Trans. Amer. Philos. Soc. (2)10: 46.
Leptostylus collaris (Haldeman). LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia, (2)2: 169. Horn, 1880, Trans. Amer. Ent. Soc. 8: 120. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 23: 120. Blatchley, 1910, Col. Ind., p. 1072. Craighead, 1923, Canada Agr. Bull. 27: 115.
Astylopsis collaris (Haldeman). Knull, 1946, Bull. Ohio Biol. Surv. 39: 246.
Amniscus interruptus Haldeman, 1847, Trans. Amer. Philos. Soc. (2)10: 46.
Leptostylus interruptus (Haldeman). LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia, (2)2: 170.

Male. Dark reddish brown to piceous, covered with cinerous pubescence, clouded with fulvous or dull brown. Head very feebly mottled with dark brown. Pronotum rather uniformly cinereous or fulvous pubescent, the disk medially rarely slightly darker than sides, with two longitudinal fuscous dashes in a line each side of middle and a less pronounced one at center. Elytra rarely with a whitish fascia near middle and sometimes with the costae whitish, entire disk with scattered, dark brown maculae varying greatly in size and disposition. Body beneath uniformly cinereous, mottled very feebly on sides of metasternum; abdomen not darker pubescent nor glabrous medially. Legs and antennae cinereous pubescent, mottled with brownish; tibiae narrowly annulate with fuscous at basal third and broadly so at apex; tarsi with last two segments fuscous; antennae with entire last segment and apices of other segments annulated with, fuscous.

Head finely, densely punctulate; front one-half wider than long, widest some distance below eye, then narrowed to mouth and between eyes above; eye with lower lobe one-seventh shorter than gena, subquadrate or feebly vertical. Pronotum one-half again as wide as long, sides nearly parallel; lateral tubercles small, occupying

about one-third (or less) of sides, but rather prominent; disk densely, moderately finely punctate, the median area sometimes slightly more densely punctate than sides, with five small tubercles. Elytra only slightly more coarsely punctate than pronotum, basal gibbosity broad, rather prominent and often subcristate; apices scarcely prolonged, feebly truncate or separately rounded. Prosternal process one-half as broad as a procoxal cavity; mesosternal process nearly four-fifths as broad as a mesocoxal cavity; fifth sternite scarcely longer than fourth, feebly retuse at apex. Antennae slightly longer than body; scape extending three-fourths across pronotum; third segment equal to first, one-fifth longer than fourth; fifth two-thirds as long as third; rest gradually shorter.

Female. As male, but fifth sternite as long as third and fourth together, its apex subtruncate or feebly emarginate.

Length 6–9 mm.; width 3–3.7 mm.

Type localities: Southern States [*collaris*]; Pennsylvania [*interruptus*].

Distribution: Northeastern United States, south to Maryland and west to Minnesota. Massachusetts: 1, no further data [CU]; 1, Plymouth Co. [CU]; 1, Brookline [CAS]. Connecticut: 2, Cornwall, July [CU]. New York: 4, Olcott, July 5–19 [CU]; 2, Bufflalo [KU]. Pennsylvania: 1, no further data [KU]. Maryland: 5, no further data [Minn.]; 1, Odenton, June 17, [CU]. District of Columbia: 1, no further data [Minn.]. Virginia: 1, no further data [CAS]. Minnesota: 1, Ramsey Co., July (R. M. Berthal) [Minn.].

Remarks: A. collaris is quite similar in appearance to *A. macula* and is best distinguished by the lack of a white fascia behind middle of elytra. However, in rare cases a sort of fascia does occur in that position; then, the uniform cinereous pubescence of the abdomen and the larger eye will be useful criteria. In *macula* the abdomen is glabrous or fuscous pubescent medially and the lower ocular lobe is distinctly shorter than the gena, while in the present case the lower lobe of eye is nearly as tall as gena.

Amniscus macula (Say)

Lamia macula Say, 1826, Jour. Acad. Nat. Sci. Philadelphia, 5: 268. LeConte, 1859, Say's Amer. Ent., II, p. 327.

Amniscus macula (Say). Haldeman, 1847, Trans. Amer. Philos. Soc., (2)10: 48.

Leptostylus macula (Say). LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia, (2)2: 169. Horn, 1880, Trans. Amer. Ent. Soc., 8: 121. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc., 23: 121. Blatchley, 1910, Col. Ind., p. 1072.

Astylopsis macula (Say). Casey, 1913, Mem. Col., IV, p. 309. Knull, 1946, Bull. Ohio Biol. Surv., 29: 245, f. 88.

Amniscus sticticus Haldeman, 1847, Trans. Amer. Philos. Soc., (2) 10: 48.

Male. Dark reddish-brown, covered with fulvous, ashy, or variegated, pubescence, and with hoary pubescence on genae, sides of prothorax legs, and entire undersurface, and forming a band behind middle of each elytron, which does not usually attain suture. Head with front and vertex mottled with brown. Pronotum each side of middle with two longitudinal, dark brown dashes in a line, one at apex, the other at base, separating the hoary sides from the darker central portion. Scutellum dark brown pubescent, sometimes ashy at middle. Elytra each with six longitudinal series of irregularly spaced, fuscous maculae, those directly posterior to the hoary band usually larger and subcoalescent. Body beneath and femora mottled with brown, the abdomen broadly glabrous or dark pubescent medially; tibiae broadly annulate at apex and narrowly so at basal third, with brown; tarsi with last two segments brown pubescent. Antennae yellowish brown, each segment narrowly infuscate at apex, except scape which is entirely reddish-brown.

Head minutely punctulate, nearly impunctate, median sulcus well marked, reaching to epistoma, front nearly one-half wider than long, widest somewhat below eyes, narrowest above mouth; eyes with lower lobe equal to three-fifths genal height, subquadrate or feebly transverse. Pronotum one-half again as wide as long, sides subparallel, at extreme apex narrowly constricted; lateral tubercles broad, arcuate, feebly elevated, placed at middle of sides; disk with five obtuse, low tubercles, area enclosed by them coarsely, punctate, sides sparsely and more finely so. Elytra much more coarsely and sparsely punctate than pronotum, basal gibbosity broad, often feeble, sometimes subcristate; apices feebly prolonged, separately rounded or obliquely truncate to suture. Prosternal process about three-fifths as broad as a procoxal cavity; mesosternum broad, about four-fifths as broad as a mesocoxal cavity; fifth sternite scarcely longer than fourth, broadly retuse at apex. Femora strongly clavate, mesofemora only feebly shorter than metafemora, equal in stoutness, front ones distinctly shorter and less robust; tarsi with first segment one-eighth shorter than next two together. Antennae slightly longer than body; scape slender, extending three-fifths across pronotum; third segment a little shorter than first, one-fifth longer than fourth, which is one-third longer than fifth; rest gradually shorter.

Female. As in male but fifth sternite as long as preceding two together, apex narrowly rounded; antennae about as long as body; and femora less strongly clavate, the metafemora less robust than mesofemora.

Length 5–8 mm.; width 2.2–3 mm.

Type locality: United States [*macula; sticticus*].

Distribution: Eastern North America, south to Virginia and west to Kansas. Quebec: 1, Cono [CAS]. Ontario: 4, Toronto [CU]. Massachusetts: 1, Sherborn [CU]; 1, Amherst [Minn.].

Connecticut: 21, Cornwall, May to August [CU]. New York: 13, Purchase [CU]; 2, Yonkers [CU]; 2, Chappaqua [CU]; 1, N. Fairhaven [CU]; 18, Olcott [CU]; 3, E. Aurora [CU]; 1, Putnam [CU]; 1, Minetta [CU]; 1, Crown Pt. [CU]; 2, Brewster [CU]; 1, Michigan Swamp, Tompkins Co. [CU]; 11, Ithaca [CU]; 1, Otto [CU]; 7, Oswego [Minn.]; 6, Cranberry Lake [CAS]. Pennsylvania: 2, Upper Darby [CAS]; 1, Clarke's Valley [CAS]. Maryland: 10, no further locality [Minn.]; 6, Odenton [CU]. District of Columbia: 1, no further locality [Minn.]. Virginia: 1, no further locality [Minn.]. Tennessee: 1, Black Mt., Cumberland Co. [CU]; 2, Crabtree [CU]; 1, North Tennessee [CU]. Illinois: 1, Rock Island [Minn.]. Minnesota: 1, St. Paul; 5, Olmstead Co.; 1, Rush Lake; 1, Minneapolis; 1, Dakota Co. [all Minn.]. Kansas: 1, Douglas Co. [CU]; 1, Leavenworth Co., June 25 [KU]. Arkansas: 1, Barnes, June 9, 1932 [KU].

Host species: Apple, hickory, black walnut, butternut, beech, and chestnut.

Remarks: The most prominent characteristic of this insect is the distinct whitish fascia behind the middle of the elytra, but it can further be identified from its congeners by its lack of tufts of blackish hairs, by the smallness of the pronotal lateral tubercles, and by the sparsity of the punctation on the sides of the pronotal disk in marked contrast to the dense punctures on the central portion. Moreover, the elytral sutural apical angle is never prominent, the prosternal process is three-fifths as broad as a procoxal cavity, and the eye has its lower lobe distinctly shorter than the gena.

Amniscus sexguttatus (Say)

Lamia 6-guttata Say, 1826, Jour. Acad. Nat. Sci. Philadelphia 5: 269. LeConte, 1859, Say's Amer. Ent., II, p. iv.

Leptostylus sexguttatus (Say). Leng and Hamilton, 1896, Trans. Amer. Ent. Soc., 23: 119. Blatchley, 1910, Col. Ind., p. 1072.

Astylopsis sexguttata (Say). Knull, 1946, Bull. Ohio Biol. Surv., 39: 245.

Lamia guttata Say. LeConte, 1859, Say's Amer. Ent., II, p. 328 [err. typ.].

Astylopsis guttata (Say). Casey, 1913, Mem. Col., IV, p. 309.

Amniscus commixtus Haldeman, 1847, Trans. Amer. Philos. Soc., (2) 10: 47.

Leptostylus commixtus (Haldeman). LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia, (2)2: 169. Horn, 1880, Trans. Amer. Ent. Soc., 8: 121.

Male. Reddish brown or dull testaceous, not densely covered with ashy pubescence, clouded variably and irregularly with brown. Head and pronotum faintly mottled with yellow-brown, with two longitudinal fuscous dashes in a slightly oblique line each side of middle and a fuscous macula or dash medially which is variable in shape and prominence. Scutellum fuscous. Elytra often largely brownish or fulvous pubescent, with six rows of fuscous-black tufts, which vary in size and position, at basal third laterally and again at apical fourth near suture, a larger fuscous macula, each of which is preceded by a whitish marking and with small whitish tufts, maculae, or dashes in the same rows as the fuscous tufts; to the unaided eye at apical third the dark pubescence appears to form a more or less complete common circlet, enclosing a white macula in well-marked specimens. Body beneath and legs ashy pubescent, the sternum and the femora mottled with brown; abdomen not glabrous medially; tibiae broadly annulate at apex and at basal third with brown; tarsi with last two segments brown pubescent, the first two sometimes annulate with the same color. Antennae largely ashy pubescent, mottled with brown and annulate on apex of each segment with brown.

Head minutely alutaceous, except front which is finely punctulate; front one-half wider than long, widest some distance below eye, then suddenly strongly constricted above mouth; eyes with lower lobe subquadrate, not quite as tall as gena. Pronotum three-fourths again as wide as long, sides a little narrowed anteriorly; lateral tubercles short, acute, distinct, placed just behind the middle; disk with five obtuse, low tubercles, the entire surface densely, finely, uniformly punctate. Elytra coarsely, rather uniformly densely punctate, basal gibbosity distinct, with a short prominent carina; disk with four more or less distinct costae; apices strongly, obliquely truncate, the sutural angle prominent, subdentiform. Prosternal process about half as broad as a procoxal cavity; mesosternal process strongly tapering, at narrowest point four-fifths as broad as a meso-coxal cavity; fifth sternite scarcely longer than fourth, the apex broadly retuse. Femora strongly clavate, becoming successively shorter anteriorly, profemora a little less robust; tarsi with first segment one-eighth shorter than next two together. Antennae slightly longer than body; scape slender, reaching just behind lateral tubercle of pronotum; third segment slightly arcuate, feebly shorter than first, one-fifth longer than fourth, which is one-third longer than fifth; rest gradually shorter.

Female. As male but fifth sternite as long as third and fourth combined, its apex broadly rounded; metafemora less robust than mesofemora, all only moderately clavate; and antennae no longer than body.

Length 6–9.5 mm.; width 2.5–3.2 mm.

Type localities: United States [*sexguttatus*]; Washington City [*commixtus*].

Distribution: Eastern North America, south to Florida and Mississippi, and west to Minnesota and Arkansas. Ontario: 4, Port Hope [CU]; 2, Prince Edward Co. [CU; Minn.]. Massachusetts: 2, Plymouth Co. [CU]. New York: 1, Olcott [CU]. Minnesota: 12, Lake Itasca; 1, Itasca Park; 2, Lake Vermillion; 1, Caledonia; 1, St. Paul; 1, Olmstead Co. [all Minn.]. Maryland: 4, no further locality [Minn.]; 1, Odenton [CU].

Florida: 1, Dunedin [CU]. Mississippi: 7, Lucedale; 1, State Line; 1, Leakesville [all CU]. Arkansas: 2, Hope [CU]. Texas: 1, Jefferson [KU].

Host species: Pine.

Remarks: The tufts of short black hairs on the elytra, best discerned in profile, form the outstanding feature of this species. Furthermore, the lateral tubercles of the pronotum are comparatively prominent and acute, the elytra at apex have the sutural angle prominent and subdentiform, the prosternal process is only one-half as broad as a procoxal cavity, and the lower ocular lobe is nearly as tall as the gena.

Amniscus arcuatus arcuatus (LeConte)

Leptostylus arcuatus LeConte, 1878, Proc. Amer. Philos. Soc., 17: 414. Horn, 1880, Trans. Amer. Ent. Soc., 8: 121. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc., 23: 118. Knull, 1942, Ent. News, 53: 227.

Leptostylus floridanus Champlain and Knull, 1922, Ent. News, 33: 148 [new syn.].

Male. Fuscous to piceous, elytra ferrugineous; densely covered with pale ashy pubescence. Head, scutellum, body beneath, legs, and antennae to sixth segment, mottled densely with brownish. Head with a small dark macula on gena behind eye. Pronotum usually clouded with pale brown medially and above legs; disk each side with two longitudinal, fuscous dashes in a line, one at apex, the other at base, median line often in part similarly fuscous; behind lateral tubercles a broad, dark brown bar. Elytra with an oblique patch on apical third and with extreme lateral margins, brownish fulvous, sides bordered above with a broad, blackish vitta extending from before humerus to apical sixth, somewhat tapering posteriorly, the apical patch margined anteriorly by a blackish band which is directly transverse near suture, but thence extends obliquely forwards to lateral vitta, being angularly broken near sides; just behind middle at suture a subtriangular, greenish brown macula that varies in prominence, sometimes being nearly absent; directly before middle on disk towards the declivous portion, a series of two or three short, blackish vittae united with a brownish cloud to form an oblique band; at basal fourth near suture a small brownish cloud, and entire disk sprinkled with a very few blackish tufts, especially on basal gibbosity, along suture, and on apical patch. Tibiae annulate at basal third and before apex with fuscous; tarsi entirely fuscous except for a cinereous annulus at base of first segment. Antennae with all segments annulate apically with fuscous, the sixth to tenth segments narrowly annulate also at base, the eleventh entirely fuscous.

Head minutely alutaceous; front finely punctulate beneath the pubescence, two-fifths wider than broad, broadest a short distance below eye, then suddenly constricted to mouth; eyes with lower lobe not quite so tall as gena, subquadrate. Pronotum three-fourths again as wide as long, sides constricted apically, lateral tubercles small, robust, subacute, and prominent; disk densely, finely punctate, the punctures a little larger in basal sulcus, but not seriately arranged, with five low, poorly defined tubercles. Elytra rather densely, moderately coarsely punctate, the punctures usually distinctly coarser on apical brown area; basal gibbosity distinct, with a short, prominent carina; disk with four more or less distinct carinae; apices distinctly obliquely truncate at suture, both angles prominent, subdentiform. Prosternal process one-half as broad as a procoxal cavity; mesosternal process four-fifths as broad as a mesocoxal cavity; fifth sternite scarcely longer than fourth, emarginate at apex. Tarsi with first segment one-eighth longer than next two together. Antennae slightly longer than body; scape slender, reaching a little beyond lateral tubercles of pronotum; third segment feebly shorter than first, one-seventh longer than fourth, which is about one-fourth longer than fifth; rest gradually shorter.

Female. Like male, but fifth sternite as long as third and fourth together, rounded at apex; and femora less robust.

Length 7–10.5 mm.; width 3–4.5 mm.

Type localities: Tampa, Florida [*arcuatus*]; Miami, Florida [*floridanus*].

Distribution: Florida and Georgia. Florida: 3, Lake Placid, April 2, and December 13, 1945 (J. G. Needham) [CU]; 1, Gainesville, July 7, 1927 (J. S. Rogers) [CU]; 1, Otter Creek, July 6, 1948 (H. W. Crowder) [KU]. Georgia: 1; Billy Island, Okefenokee Swamp, May 11, 1921 [CU].

Remarks: The blackish vitta along the sides of the elytra and the elytral punctation are the outstanding features of this species.

Amniscus arcuatus knulli (Fisher)

Leptostylus knulli Fisher, 1925, Proc. Ent. Soc. Washington, 27: 103.

Male. As the nymotype, but lacks the ashy pubescence, which is replaced by brown and many of the blackish markings are wanting. As a result, the insect presents a nearly uniform dull brown appearance. Pronotum with the usual markings but these are not as distinct as in the nymotype. Elytra with apical brown patch only slightly darker than rest of disk, bordered anteriorly only by a short, oblique, black streak, which does not attain suture and reaches only to the middle of the width, and which is itself preceded by a short whitish streak; sides with black vitta as in nymotype. Body beneath sparsely covered with dull ashy pubescence, unmottled.

Type locality: Dorchester Co., Maryland.

Distribution: Southeastern States, except Florida and Georgia. Alabama: 1, Mobile, Dec. 15, 1939 [CAS]. North Carolina: 1, Chapel Hill, June (J. Valentine) [AMNH]. South Carolina: 1, Florence, June 22, 1953. [PDES]. Missis-

sippi: 1, Lucedale, April 28, 1929 (H. Dietrich) [CU]. Arkansas: 3, Hope, May and August [CU].

Remarks: The specimen from Mississippi is mottled on the undersurface and shows characters that intergrade with the nymotype, as does also the single example from South Carolina.

Amniscus perplexus Haldeman

FIG. 5

Amniscus perplexus Haldeman, 1847, Trans. Amer. Philos. Soc., (2)10: 46.

Leptostylus perplexus (Haldeman). LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia, (2)2: 169. Horn, 1880, Trans. Amer. Ent. Soc., 8: 120. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc., 23: 120.

Male. Dark reddish-brown to fuscous, rather densely covered with fulvous, or ashy and fulvous pubescence, broadly and variably clouded with brown, and often mottled with dark brown. Pronotum usually broadly brownish medially, but without the dark bars that characterize other members of this genus. Scutellum largely fuscous pubescent. Elytra with apical third darker than rest of disk, the dark area with its anterior margin often sinuous, oblique, extending from a blackish macula at suture postero-laterally to sides, anterior to this area usually with a poorly defined, variable ashy area, broader along suture; disk sometimes with indistinct vittae or scattered maculae of bright fulvous; sides anteriorly darker. Body beneath and legs ashy pubescent, finely and rather densely mottled with brown; tibiae scarcely or not at all annulate with dark brown only at apex; tarsi uniformly, sparsely ashy pubescent. Antennae dark reddish-brown, somewhat lighter distally from fifth segment, cinereous pubescent, mottled on basal segments with brownish, the segments beginning with third indistinctly annulate with fuscous apically.

Entire upper surface minutely alutaceous. Head above with a few setigerous punctures between eyes, rest impunctate; front densely punctulate, widest directly at lower angle of eye, one-third wider than long; eyes with lower lobe subquadrate or feebly transverse, subequal to gena in height. Pronotum one-half again as broad as wide, sides subparallel; lateral tubercles placed just behind middle, low but rather broad, obtuse; disk finely, not very densely, but distinctly punctate, extreme sides very sparsely so and devoid of punctures medially; disk with three small but distinct tubercles, the two anterior ones a little more pronounced than the posterior median one. Elytra punctate as pronotal disk; basal gibbosity broad, somewhat prominent; disk indistinctly sprinkled with small conical tubercles; apices feebly acuminate, separately broadly rounded. Prosternal process one-third as broad as a procoxal cavity; mesosternal process two-thirds as broad as a mesocoxal cavity; fifth sternite slightly longer than fourth, broadly arcuate at apex. Antennae with ninth segment attaining elytral apex; scape slender, extending feebly behind middle of pronotum; third segment very feebly longer than first; fourth three-fourths, and fifth two-thirds, as long as first; rest gradually shorter.

Female. Similar to male but fifth sternite nearly as long as third and fourth together, and antennae only as long as body.

Length 8–10 mm.; width 3–4 mm.

Type locality: "Georgia, Florida".

Distribution: Florida and Georgia. Florida: 1, Miami, August, 1938 [Miami]; 2, Dade Co., May 31, 1951 [Miami]; 1, Gulfport (M. Cazier) [AMNH].

Remarks: This species differs from the other members of the genus in the form of the front. The lack of punctures at the middle of the pronotal sides and the uniformly ashy pubescent tarsi are other good recognition characters.

Glaucotes Casey

Glaucotes Casey, 1913, Mem. Col., IV, p. 305.

Large, robust, subcylindrical beetles. Head finely, sparsely punctate on front and genae, and with a very few setigerous punctures around eye; front one-half again as wide as high, broadest at lower angle of eye, narrowed slightly to mouth and a little more strongly between eyes; eyes separated above by distance equal to about twice the width of the upper lobe, lower lobe transverse, slightly shorter than gena in height. Pronotum about half again as broad as long, lateral tubercles placed near basal two-fifths, broad, not prominent, obtusely angulated or rounded apically; disk distinctly punctate, especially on median area, with five low, poorly indicated tubercles; transverse sulci shallow but distinct. Elytra each with four entire costae, without tufted tubercles, but entire surface covered with short, erect setae, rather densely placed; basal gibbosity broad, not prominent; apices subacuminately, separately, narrowly rounded. Prosternal process angularly expanded each side into procoxa, about three-fourths as broad as a procoxal cavity; mesosternal process about as wide as a mesocoxal cavity; fifth sternite in male as long as fourth, in female about half again as long as fourth. Legs robust, increasing in length successively from front to rear; femora with short, erect hairs, clavate, scarcely pedunculate at base; matatarsi with first segment subequal to next two together, slightly shorter on mesotarsi and much shorter on protarsi. Antennae scarcely longer than body in male, slightly shorter than body in female, sparsely fimbriate beneath on first five or six segments; scape with erect hairs above as well, extending to basal two-fifths of pronotum, produced beneath at apex; third as long as first; fourth four-fifths, fifth about half, and sixth about two-fifths as long as first; rest gradually shorter.

Genotype: Leptostylus yuccivorus Fall, by original designation.

Remarks: This genus is very close to *Trichastylopsis* in the angulated prosternal process, in the erect (but in this case short) hairs on the femora, and in the fimbriate antennae. From that genus it is distinct in having the front one-half again as broad as high, the lower ocular lobes transverse, shorter than genae. The pronotum here is not so broad and not depressed posteriorly and its disk bears five low tubercles. And, in addition, the elytra are not tufted but are entirely covered by short, erect setae.

Glaucotes yuccivorus (Fall)

FIG. 6

Leptostylus yuccivorus Fall, 1907, Jour. New York Ent. Soc., 15: 83.

Glaucotes yuccivorus (Fall). Casey, 1913, Mem. Col., IV, p. 305.

Male. Dark reddish brown, not very densely covered with ashy pubescence. Head above and pronotum on sides strongly varied with ochraceous or fulvous. Pronotum with two short, blackish bars on apical margin, one near each side, and at middle of apex a similar inverted "V", at each side on basal margin opposite the apical bars a short, broad, blackish vitta directed toward an arm of the inverted "V", median line largely blackish on basal half; behind lateral tubercle an irregular fuscous macula. Scutellum often fuscous medially. Elytra each with four or five poorly defined, ochraceous or fulvous vittae; humerus on anterior margin with an elongate, fuscous macula. Antennae dark reddish brown, ashy pubescent, the first four segments mottled with dark brown; the segments beginning with third annulate on apices with dark brown.

Entire upper surface minutely alutaceous and densely punctulate. Head impunctate, except for several setigerous punctures above near upper ocular lobes and one or two below eye or on sides of front; front convex, lacking lateral sutures, one-half again as broad as high; eyes with lower lobe transverse, slightly taller than the gena, upper lobes separated above by nearly twice one of their widths. Pronotum more than half again as broad as long; lateral tubercles broad but low, rounded or obtusely angulate apically; disk rather finely, not densely punctate, punctures usually denser on median area than on sides, with five broad, scarcely elevated tubercles, two before apex, three behind middle, basal sulcus with a row of punctures but apical sulcus often lacking a similar row. Elytra densely, coarsely punctate, the punctures becoming finer apically but not sparser; basal gibbosity broad, feebly indicated; each disk with four entire costae, without tubercles, entire disk densely covered with short, erect setae; apices feebly acuminate, separately rounded. Antennae scarcely longer than body, sparsely fimbriate beneath on basal segments; scape with erect setae above as well as below, attaining apex of pronotal lateral tubercles.

Female. As male but fifth sternite longer than fourth and antennae distinctly shorter than body.

Length 12–15 mm.; width 4–5.5 mm.

Type locality: San Bernardino Ranch, Douglas, Arizona.

Distribution: Arizona. Arizona: 5, Douglas, August (F. H. Snow) [KU]; 1, Douglas, June, 1931 (W. W. Jones) [CU].

Remarks: This species is easily recognized by the entire fulvous or ochraceous vittae of the elytra and by the short, rather dense, erect setae that cover the same organs.

Coenopoeus Horn

Coenopoeus Horn, 1880, Trans. Amer. Ent. Soc., 8: 117, Leng and Hamilton, 1896, Trans. Amer. Ent. Soc., 23: 115.

Large, robust, subcylindrical forms. Head above and on front punctate; front two-fifths again as wide as long, widest at lower angle of eye; eyes separated above by one and one-half times the width of an upper lobe, lower lobe subequal to, or one-half again as tall as, gena; lower margin of clypeus bilobed, emarginate medially. Pronotum nearly (or quite) one-half again as wide as long, sides subparallel, often distinctly constricted basally; lateral tubercles broad, rounded, not very prominent, situated at middle of sides; disk coarsely, sparsely punctate, with transverse series of punctures near base and apex, with about five broad, feeble tubercles, often scarcely discernable. Elytra without costae, tubercles, tufts, or basal gibbosity, basally coarsely punctate, punctures evanescent apically; apices separately rounded or broadly truncate. Prosternal process about one-fourth as broad as a procoxal cavity; mesosternal process between three-fifths and two-thirds as broad as a mesocoxal cavity, expanded apically. Legs moderate in length, becoming successively longer from front to rear pairs; femora robust, capitate, pedunculate at base; tarsi with claws not strictly divaricate; first segment somewhat shorter than next two segments together, but only slightly so on metatarsi. Antennae slightly shorter or slightly longer than body, not ciliate beneath; scape subconical, scarcely surpassing middle of pronotum; third one-sixth to one-fourth shorter than first; fourth about two-thirds and fifth about half, as long as first; sixth segment in male with a nodule on inner side at apex; rest gradually decreasing in length.

Genotype: Leptostylus palmeri LeConte, by original designation and monotypy.

Remarks: This genus is distinct from other North American members of the tribe in having the tarsal claws not strictly divaricate, meeting one another at slight angle. Furthermore, the

lower margin of the clypeus is bilobed, not truncate or broadly emarginate as elsewhere.

KEY TO SPECIES

Body surface shining, extremely sparsely covered with short, fuscous pubescence, devoid of any pale pubescent markings; tibiae not annulate; antennae annulate only on third to seventh segments; elytra densely, coarsely punctate, punctures distinct nearly to apex ..... **niger**

Body surface largely covered with fuscous and pale pubescence, not shining; tibiae broadly ashy annulate medially; antennae with bases of all segments ashy annulate; elytra rather sparsely punctate, punctures suddenly obsolete behind middle ..... **palmeri**

Coenopoeus palmeri (LeConte)

FIG. 8, 9.

Leptostylus Palmeri LeConte, 1873, Smiths. Misc. Coll., No. 264, p. 233.

Coenopoeus palmeri (LeConte). Horn, 1880, Trans. Amer. Ent. Soc., 8: 118, pl. 2, f. 1. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 23: 115.

Male. Black, subopaque, densely covered with short, fine, fuscous pubescence. Pronotum and elytra usually maculated with ashy or grayluteous pubescence, which in rare instances nearly entirely covers these organs; on the pronotum the basal margin usually is pale pubescent, and the sides and central part of disk are variably maculate with the pale pubescence, but quite frequently lack it entirely. Elytra in fully marked forms have the pale pubescence interrupted by fuscous markings as follows: a short narrow band at basal sixth near suture, a lateral discal, quadrate macula just before middle, an angulate, often macular band just behind middle, and a slightly narrower similar band at apical fourth that does not attain the suture, the entire disk with sparse points of fuscous, larger along suture; however, the extreme base and the entire apical portion is often entirely fuscous, and frequently the pale pubescence is reduced to a broad band at basal third, or it may be entirely absent. Body beneath variably sprinkled with ashy pubescence. Legs with coxae and femora sparsely ashy pubescent; tibiae annulate with ashy medially. Antennae with all segments (except second) broadly annulate with ashy at base.

Entire upper surface minutely alutaceous. Head above minutely punctate; front more coarsely punctate, widest at lower angle of eye, two-fifths wider than long; clypeal margin biarcuate, deeply emarginate at middle; eyes with lower lobe subquadrate, taller by one-half than gena. Pronotum across tubercles half again as wide as long, lateral tubercles situated very feebly behind middle of sides, broad, subacute or rounded; disk uneven but without any well-defined tubercles, impunctate or with scattered punctures, a series of fine punctures in apical sulcus, of coarse ones in basal sulcus. Elytra sparsely covered with rather coarse punctures, which suddenly become obsolete behind middle; disk with basal gibbosity obsolete or wanting, without costae; apices squarely, broadly truncate or separately broadly rounded. Prosternal process little more than one-quarter as broad as a procoxal cavity; mesosternal process two-thirds as broad as a mesocoxal cavity; fifth sternite scarcely longer than fourth, broadly retuse at apex. Tarsi not fringed, with first segment not so long as next two together, but on all legs distinctly elongate, clearly longer than third. Antennae robust, scarcely longer than body, not ciliate beneath; scape conical, slender, scarcely surpassing middle of pronotum; third segment five-sixths as long as first; fourth two-thirds and fifth only half, as long as first; rest gradually shorter; sixth segment on inner surface at apex with nodule or short projection.

Female. As male but fifth sternite distinctly longer than fourth, its apex broadly rounded, and antennae only as long as body, the sixth segment not nodulose.

Length 18–24 mm.; width 6.5–9 mm.

Type locality: Arizona.

Distribution: Southwestern United States. Arizona: 2, Texas Pass, July 19, 1917 [CU]; 7, Baboquivari Mts. [CU]; 2, Douglas [KU]; 2, Globe [CU]; 2, Black Mts. [KU]. California: 4, Southern California [Minn.]; 1, Sonora [CU].

Remarks: The presence of at least some fuscous pubescence on the upper surface will distinguish this extremely variable insect from its sole known congener. The ashy median annulation of the tibiae is also diagnostic.

Coenopoeus niger Horn

Coenopoeus niger Horn, 1894, Proc. Calif. Acad. Sci., (2)4: 402.

Female. Black, shining, everywhere extremely sparsely covered with very short, fuscous pubescence. Antennae broadly but not prominently annulate with hoary on bases of segments 3 to 7.

Entire upper surface minutely, densely punctulate and alutaceous. Head above and on front finely, sparsely punctate; front widest at lower angle of eye, two-fifths wider than tall; eyes with lower lobe slightly transverse, subequal to gena in height. Pronotum strongly constricted at base, lateral tubercles not prominent, their apices angularly rounded; disk somewhat uneven but without distinct tubercles, with rather coarse punctures, sparse medially but dense in the apical and basal sulci. Elytra rather densely, coarsely punctate, punctures less distinct behind apical third, subobsolete before apex; apices separately narrowly rounded. Prosternal process about one-fourth as broad as a procoxal cavity; mesosternal process three-fifths as broad as a mesocoxal cavity; fifth sternite one-half again as long as fourth, its apex feebly retuse. Tarsi

with first segment not so long as next two together, but distinctly elongate, longer than third. Antennae robust, distinctly shorter than body, with scape not attaining middle of pronotum, conical; third segment nearly one-fourth shorter than first; fourth three-fifths as long as first; fifth scarcely more than half as long as first; rest gradually shorter.

Length 18–23 mm.; width 6.3–7 mm.

Type locality: El Chinche, Baja California.

Distribution: Southern and Lower California, California: 2, Southern California [KU].

Remarks: From *palmeri* LeConte, this species is easily distinguished by the absence of pale pubescent markings on the body, by the absence of annulae on the legs, by the deeper, coarser, and more extensive punctation of the elytra, by the presence of annulation only on the third to seventh segments of the antennae, and by the smaller lower lobe of eye.

Styloleptus Dillon, gen. nov.

Small, subdepressed forms, with the prothorax especially depressed. Head impunctate above and on front; the latter rather convex when viewed from sides, meeting labrum at an angle of about 135°, widest directly at the lower angle of eye, one-half again as wide as high, tapering to mouth and narrowed between eyes; eyes separated above by a distance equal to one and three-fourths the width of an upper lobe, lower lobe equal to gena in height. Pronotum subdepressed, widest across basal third, not quite twice as broad as long; lateral tubercles broad, unarmed, imperceptably merging with side margins anteriorly, strongly angularly rounded to the constricted base; disk without tubercles, very finely, indistinctly punctate; basal and apical sulci straight, paralleling respective margins, shallow, indistinct. Elytra densely punctate but punctures largely concealed by vestiture, with several prominent costae and usually with a number of fine elevated points or fine tubercles; basal gibbosity nearly wanting; apices obliquely truncate at suture. Prosternal process one-fourth to one-third as broad as a prosternal cavity; mesosternal process at least four-fifths as broad as a mesocoxal cavity; fifth sternite in male slightly longer, in female one-half longer, than fourth. Legs with last two pairs successively longer than first; femora clavate, strongly pedunculate at base, the two hind pairs arcuate; protarsi with first segment distinctly longer than third, first segment of other two pairs of legs successively longer, on metatarsi nearly as long as second and third segments together. Antennae slender, one-third to one-half again as long as body, not ciliate beneath; scape moderately robust, extending nearly to basal third of pronotum, scarcely prominent at apex on lower surface; third segment one-eighth to one-fifth longer than first, arcuate; fourth nearly as long as first; fifth nearly three-fifths as long as first; rest gradually shorter.

Genotype: Leptostylus biustus LeConte.

Remarks: The members of this genus have long been listed in the genus *Leptostylus* but are amply distinct from the members of that genus and such related genera as *Leptostylopsis* in having the front convex, the pronotum subdepressed, lacking discal tubercles, and in the form of the unarmed, broadly rounded lateral tubercles, which are located at the posterior third of the structure. In fact, this latter character will distinguish the members of this genus from all others in the tribe.

KEY TO SPECIES

Elytra usually with only a single oblique, dark, apical fascia, if an additional dark marking is present apicad of it, the latter is maculiform and does not extend beyond center of disk from sides; the lateral black marking is almost always entire, extending from behind eye to a point on the elytra opposite the end of the metasternum; pronotum with disk usually clouded with pale brown but not fuscous; general coloring of pubescence cinereous; body size from 4.5 to 7 mm; broadly distributed over eastern United States, including Florida . . . . . **biustus**

Elytra usually with two more or less parallel dark fasciae apically, sometimes interconnected with fuscous; lateral black marking usually broken into a small macula on apex of pronotum and a large spot on humerus, sometimes there is an additional arcuate patch on sides of elytra and rarely it is entire; pronotum broadly and heavily maculate with fuscous; general coloring of pubescence fulvous; body size 4.5–5.5 mm; in Florida only . . . . . **minuens**

Styloleptus biustus biustus (LeConte)

Leptostylus biustus LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia, (2)2: 169. Horn, 1880, Trans. Amer. Ent. Soc., 8: 121. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 8: 119.

Leptostylus bahamicus Fisher. Champlain and Knull, 1926, Ent. News, 37: 206 [misdet.].

Male. Reddish-brown or testaceous (Southwestern specimens often the paler color), covered densely with dull ashy or silvery-white pubescence. Head and pronotum finely, sometimes indistinctly mottled with brown or fulvous; the pronotum variably maculate at middle of disk, sometimes with four black maculae (on median line a small one at apex and another occupying basal half, and a small one each side of middle at apical fourth) and sometimes with six brown or fulvous dashes (one each side on apical margin, two similar ones opposite them on the basal margin, and one on basal third on each side of middle). Elytra with scattered, elevated, black points especially on base, along suture, and on apical third; entire apical third fulvous or brownish, defined anteriorly by a more or less pronounced straight streak of darker hue extending obliquely from near middle of suture (at an angle

of about 60°) to sides; sides black from below humeri to slightly behind middle, the black area widening to about basal third, and extending anteriorly across sides of prothorax often onto genae behind eyes. Body beneath somewhat paler than above, rather sparsely, uniformly covered with hoary or silvery pubescence. Legs dark reddish-brown, hoary pubescent; femora mottled with brownish; a broad annulation at apex of tibiae and entire tarsi black or fuscous. Antennae reddish-brown or testaceous, covered with ashy pubescence and mottled with brownish; all segments narrowly annulate with fuscous on apices and base; eleventh entirely dark.

Entire upper surface densely minutely alutaceous. Head impunctate; front one-half again as broad as long, widest at lower angle of eye, thence strongly narrowed to mouth, between eyes subparallel; eyes with lower lobe as tall as gena, vertical. Pronotum broadest across basal third, not quite twice so broad as long, sides extending obliquely from near apex into the broad, arcuate tubercle, then narrowly constricted at base; disk without distinct tubercles, its entire surface minutely, not densely punctate. Elytra with punctation largely concealed by pubescence, punctures where visible as fine as those of pronotum, more sparsely placed; with five more or less distinct costae, which are accentuated by irregularly spaced small tubercles; basal gibbosity low, not well defined; apices narrowly, obliquely truncate at suture, the marginal angle subdentiform. Prosternal process one-third as broad as a procoxal cavity; mesosternal process nearly as broad as a mesocoxal cavity; fifth sternite slightly longer than fourth, its apex feebly retuse. Legs successively longer posteriorly; femora clavate; tarsi slender, gradually widening to apex of third segment, first segment not quite so long as next two together, the second as long as the third (exclusive of terminal tuft). Antennae one-third or more longer than body, the seventh segment surpassing elytral apex; scape slender, extending to basal third of pronotum; third segment about one-eighth longer than scape, arcuate; fourth feebly shorter than scape; fifth two-thirds as long as fourth, one-half as long as third; rest gradually shorter.

Female. As male, but fifth sternite one-half longer than fourth; and antennae only one-quarter again as long as body.

Length 4.5–7 mm.; width 2–2.8 mm.

Type locality: Southern and Middle States.

Distribution: Southeastern portion of the United States, from New York to Florida, west to Iowa and Texas. New York: 1, Orient, L. I. [CU]; 2, New York [AMNH]. Pennsylvania: 1, Franklinville [KU]. Maryland: 1, no further data; [Minn.] Virginia: 2, no further data [Minn.]. North Carolina: 1, no further data [Minn.]. South Carolina: 1, no further data AMNH]. Georgia: 5, Jesup [TAM]. Alabama: 16, Mobile Co. (H. P. Loding) [CAS]. Florida: 8, Marco, Apr. 10–20, 1912 [AMNH]; 2, Punta Gorda [AMNH]; 2, Lakeland [AMNH]; 1, Biscayne Bay [AMNH]; 4, Miami [CU; AMNH]; 5, Paradise Key, Apr. 6 [CAS]. Mississippi: 3, Lucedale [CU]; 1, Leakesville [CU]. Louisiana: 3, no further data [KU; AMNH]; 5, New Orleans [CAS]. Arkansas: 1, Hope [CU]. Texas: 3, College Station [TAM]; 2, Dickinson [TAM]; 1, Columbia, bred from fig. [TAM]. Indiana: 2, Marion Co. [CU]. Iowa: 3, no further data [Minn.].

Remarks: The dark streak on the elytra meets the *middle* of the suture at an angle of 60° in this species; the form of the lateral black marking combines with this to form the chief recognition characters of the species. In this form the lateral black markings form a vitta continuous from behind eye to beyond the middle of the elytra. Only exceptionally is there any interruption and when one does occur, it is brief.

An examination of a paratype of *L. bahamicus* Fisher reveals it to be a subspecies of the present form. While pale forms intergrading between *biustus* and *bahamicus* do occur in Florida, there is no reason to assign them the latter name.

Styloleptus minuens (Hamilton)

Liopus minuens Hamilton, 1896, Trans. Amer. Ent. Soc., 23: 123.

Leptostylus pusillus Blatchley, 1925, Can. Ent., 42: 167. [new syn.].

Leptostylus scurra var. *dorsalis* Fisher, 1926, Proc. U. S. Natl. Mus., 68: 21 [new syn.].

Male. Dark testaceous to stramineous, rather densely covered with ashy or brown-ashy pubescence. Head more or less mottled with brownish, at middle of vertex with two blackish maculae which often fuse to form a crossbar; front with a small median blackish macula and with touches of blackish on antennal tubercles. Pronotum with a broad, median, dark brown vitta (paler towards its center) and including a variable number of darker maculae, often as follows: one at middle and one each side on apical margin, one larger each side of middle and one, often elongate, at middle of base; near lateral tubercles one or two dark points; and on base toward each side a small brown macula; on sides a small fuscous macula at anterior angle. Scutellum (and area around it) dark brown or fuscous, sometimes with ashy pubescence. Elytra with a number of conspicuous black tufts scattered irregularly over the disk; each disk with an oblique blackish macula beginning at middle of suture and combining with several black tufts and other blackish macula to form a short band which does not nearly attain side (at a 60° angle with suture), frequently broadly outlined with white anteriorly; behind this another similar macular band, parallel to the first, attaining the side but not the suture; with scattered, inconstant whitish maculae and

dashes, especially along suture and at base; on sides a blackish spot on anterior margin of humerus, and, beginning at basal fifth, a fuscous vitta that reaches just to middle of elytra. Body beneath and legs testaceous, ashy pubescent, mottled with fulvous; tibiae broadly biannulate with fuscous; tarsi blackish, apices of each segment narrowly ringed with hoary. Antennae testaceous, covered with ashy pubescence, mottled with brown and each segment annulate or biannulate with fuscous.

Entire upper surface minutely alutaceous. Head impunctate; front widest at lower angle of eye, thence strongly narrowed to mouth, and a little narrowed to antennal tubercles, about one-half again as broad as long; eyes with lower lobe subquadrate, equal to gena in height. Pronotum broadest across basal third, not quite twice so broad as long, sides extending obliquely from near apex into the broadly subangulate tubercle, then strongly constricted at base; disk with three feeble tubercles medially, very sparsely, finely punctate, with a row of coarser punctures in basal sulcus. Elytra at least at base visibly punctate, the punctures very slightly coarser than those of pronotal disk and more sparsely placed; costae obsolete, beset with scattered low tubercles (beneath the black tufts); basal gibbosity low, poorly defined; apices rather broadly, obliquely truncate at suture, the angles not prominent. Prosternal process only about one-fourth as wide as a procoxal cavity; mesosternal process only feebly tapering, four-fifths as broad as a mesocoxal cavity; fifth sternite one-half longer than fourth. Legs successively longer posteriorly; femora strongly clavate; tarsi as in *biustus*. Antennae nearly one-half again as long as body; scape moderately robust for the group, extending to basal two-fifths of pronotum; third segment one-fifth longer than first, arcuate; fourth nearly as long as first; fifth three-fifths as long as fourth, rest gradually shorter.

Female. As male but femora less robust; fifth sternite a little more elongate; and antennae only one-third longer than body.

Length 4.5–5.5 mm.; width 1.6–2.2 mm.

Type localities: Lake Worth and Biscayne Bay, Florida [*minuens*]; southern Florida [*pusillus*].

Distribution: Southern Florida. Florida: 1, Cape Sable, April 4, 1925 (W. S. Blatchley) [CU]; 1, Paradise Key, April 10, 1921 (J. N. Knull) [Minn.]; 1, Miami, April 12, 1921 (J. N. Knull) [KU]; 2, Lake Okechobee, May 2 [AMNH]; 1, Everglades, April 9, 1912 [AMNH]; 2, Marco [AMNH]; 1, Fort Myers [OSU]; 2, Royal Palm Park, Mar. 24, 1927 (W. S. Blatchley) [CAS].

Remarks: This species is easily recognizable by the black tufts on elytra and by the presence toward elytral apices of two parallel oblique bands. In addition, the lateral black markings are usually reduced to a small macula behind eye, a small spot at apical angle of pronotum, a longer one on anterior margin of humerus, and a short vitta (often wanting) on sides of elytra from basal fifth to middle. Furthermore, the lower ocular lobe is only equal in height to the gena.

The Cape Sable specimen listed above was determined by Blatchley and, judging from the date, was undoubtedly in his hands when he described *pusillus* and probably is a paratype. There is no difference between this and the other specimens all fitting Hamilton's original description very well.

Occasionally almost the entire elytral disk, except at humeri and apex, is black, with a few feeble indications of pale vittae; this is the form (at least in part) described by Fisher as *scurra* var. *dorsalis*.

The single example from Fort Myers has the lateral dark marking entire, quite as in *biustus*.

Nyssodrysina Casey

Nyssodrys Bates. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc., 23: 133 [misdet.].
Nyssodrysina Casey, 1913, Mem. Col., IV, p. 309.

Moderately small, subdepressed beetles. Head impunctate but above with a short, glabrous, transverse sulcus between anterior portion of eyes; front feebly convex, widest between lower angles of eyes, about as wide as long, gradually narrowed between eyes; eyes above separated only by about the width of one upper lobe, lower lobes narrowing below, twice as tall as gena. Pronotum subdepressed, widest just before base, one-half again as wide as long, lateral tubercles not well marked except by the long, acute tooth; disk without tubercles, impunctate except in basal sulcus, which is abbreviated by the lateral tubercles. Elytra without costae, basal gibbosity more or less wanting, punctures distinct nearly to apices, which are obliquely truncate. Prosternum one-fourth as wide as a procoxal cavity; mesosternal process little more than one-half as wide as a mesocoxal cavity. Fifth sternite not much longer than fourth in male, longer than third and fourth together in female. Legs rather elongate in male, shorter in female, femora clavate, robust, pedunculate at base; metatrochanter prolonged into a blunt tooth in both sexes; tarsi sparsely ciliate, first segment of protarsi three-fifths as long as next two together, mesotarsi with first segment nearly as long as, and metatarsi with it distinctly longer than, next two segments together. Antennae slender, with a very few short cilia beneath, one-half to two-thirds longer than body; first segment reaching to basal fourth of pronotum, very nearly as long as third; fourth segment one-tenth shorter than first; fifth three-fourths, and sixth three-fifths, as long as first; seventh a little shorter than sixth; eighth and ninth each as long as sixth, next two shorter.

Genotype: Liopus haldemani LeConte, by monotypy and original designation.

Remarks: The basal position of the lateral tubercles of pronotum, the antennal formula, and the large, tapering lower ocular lobe, together with the subquadrate, nearly flat front, will serve to distinguish this genus.

Nyssodrysina haldemani (LeConte)

Liopus haldemani LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia, (2)2: 173. Horn, 1880, Trans. Amer. Ent. Soc., 8: 124.
Nyssodrys haldemani (LeConte). Horn, 1886, Trans. Amer. Ent. Soc., 13: xii. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 23: 133.
Nyssodrysina haldemani (LeConte). Casey, 1913, Mem. Col., IV, p. 309.

Male. Ferruginous to dark brown, rather sparsely covered with silky ashy pubescence. Head luteous maculate above at middle. Pronotum on disk on each side of middle with a lunate, luteous vitta and with one or two short, luteous vittae near each side anteriorly. Elytra each with three luteous vittae, irregularly interrupted, the lateral one most nearly entire, all broadly interrupted behind middle by an indistinct brownish band which is outlined posteriorly by the luteous. Tibiae indistinctly annulate with darker pubescence apically, as are all the antennal segments.

Entire upper surface minutely alutaceous. Head impunctate, with a fine sulcus above antennal tubercle running transversely from the anterior margin of the upper ocular lobes; front widest at lower angle of eyes, about as wide as long, gradually narrowed between eyes; eye with lower lobe more than twice as tall as gena, gradually narrowed below. Pronotum widest just before base, one-half again as wide as long, lateral margin obtusely angulate and extending to the suddenly and narrowly constricted base and interrupting the basal sulcus; disk subdepressed but more convex than apical and basal margins, without tubercles, impunctate except in apical and basal sulci. Elytra without distinct costae or basal gibbosity, moderately coarsely, rather densely punctate on basal third, punctures thence finer and irregularly seriate to apex, the extreme apical tenth entirely devoid of punctures; apices feebly acuminate, obliquely truncate to suture, the angles not prominent. Prosternal process narrow, scarcely one-eighth as broad as a procoxal cavity; mesosternal process not quite three-fifths as broad as a mesocoxal cavity; fifth sternite about one-fourth again as long as the fourth, deeply emarginate at apex. Legs, especially posterior ones, elongate, metafemora attaining apex of elytra; metatrochanter very feebly produced into a short, blunt tooth; tarsi sparsely ciliate. Antennae two-thirds again as long as body, slender, with a very few short cilia beneath; scape extending to basal quarter of pronotum, slender, not at all expanded apically; third segment very little longer than first; fourth one-tenth shorter than first; seventh a little shorter than sixth; eighth and ninth as long as sixth; tenth and eleventh successively slightly shorter.

Female. As male, but legs shorter, metafemora not attaining elytral apices; fifth sternite slightly longer than next two together, broadly truncate apically; and antennae only nearly one-half again as long as body. The metatrochanter are similarly modified.

Length 8.5–9 mm.; width 3.5 mm.

Type locality: Alabama.

Distribution: Florida to Maryland. Florida: 1, no further data [CAS]. Georgia: 1, Savannah [CAS]; 9, no further data [KU; Minn.]. Maryland: 1, no further data [Minn.].

Remarks: In no way is *N. contempta* Bates a synonym of the present form as stated by Horn (1880) and echoed by Leng and Hamilton (1896). In that species, the ovipositor is more strongly elongated, being about as long as the three preceding segments together, the elytra are more deeply sulcate, and its punctures are confined to the sulci. In addition, there are some minute, but constant, differences in the maculation.

Astyleiopus Dillon, gen. nov.

Moderately small, elongate-ovate, robust forms. Head impunctate, feebly impressed medially on vertex; front somewhat transverse, sides nearly parallel, feebly narrowed below, only slightly convex; mouthparts placed at about an angle of 160° to the front; eye with lower lobe oblong, erect, variable in size, ranging from shorter than gena to one and one-fourth times its height, isthmus quite narrow, upper lobe a little less than half as broad as interocular space. Pronotum distinctly transverse, one-half (more or less) again as wide across lateral tubercles as long, sides broadly arcuate, not constricted at base; lateral tubercles subobsolete, continuous with sides, placed at basal third, armed with a short, upturned spine; disk with three low tubercles, entire surface except tubercles irregularly punctate; basal transverse sulcus scarcely indicated, interrupted at sides. Elytra convex, rather coarsely, not densely punctate to apices; basal gibbosity variable in prominence; disk with four prominent, subentire, simple costae; apices separately broadly rounded or subtruncate. Prosternal process one-fourth as broad as a procoxal cavity; mesosternal process nearly half as broad as a mesocoxal cavity, at apex somewhat flared laterally, the tip broadly emarginate. Fifth sternite in male equal to fourth, in female tapering and equal to third and fourth together. Femora robust, clavate, metafemora a little more slender than mesofemora in male, much more so in female, attaining apex of fourth sternite in the latter, of the fifth in the former; protibiae unarmed. Antennae about one-fifth again as long as body, beneath scarcely fimbriate on basal seg-

ments; scape attaining basal sulcus of pronotum, as long as or feebly longer than third; rest gradually diminishing in length.

Genotype: Amniscus variegatus Haldeman.

Remarks: This genus is somewhat intermediate between *Amniscus* and *Sternidius* in many of its characters. From the latter it is distinct in having the front less convex, the mouthparts placed only at a slight angle to it, the lower ocular lobe erect, oblong, and the prosternal process broader, being one-fourth as broad as procoxal cavity. From both genera it is distinct, moreover, in the pronotal characteristics, especially in the lateral tubercles being low, interrupting the basal sulcus, and in the sides being broadly arcuate, not constricted at base.

Astyleiopus variegatus Haldeman

Fig 7.

Amniscus variegatus Haldeman, 1847, Trans. Amer. Philos. Soc. (2)10: 47.

Liopus variegatus (Haldeman). LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia, (2)2: 172. Horn, 1880, Trans. Amer. Ent. Soc. 8: 124. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 23: 122. Blatchley, 1910, Col. Ind., p. 1074.

Leiopus variegatus (Haldeman). Knull, 1946, Bull. Ohio Biol. Surv. 39: 248.

Sternidius variegatus (Haldeman). LeConte, 1873, Smiths. Misc. Coll., 254, p. 235.

Amniscus variegatus var. *trifasciatus* Haldeman, 1847, Trans. Amer. Philos. Soc. (2)10: 47.

Amniscus variegatus var. *obscurus* Haldeman, 1847, Trans, Amer. Philos. Soc. (2)10: 47.

Male. Light ferrugineous to black, rather sparsely clothed with pubescence which ranges from dull fulvous to light brown in color and which is interrupted on pronotum and elytra by the impressed punctures. Head irregularly variegated with brown or blackish, often with a rounded macula each side of middle near occiput. Pronotum on disk with a dark M-shaped marking in well-marked examples, often irregularly broken or reduced; on deflexed sides with a vague brownish cloud or irregular maculations. Scutellum broadly black on sides, fuscous pubescent, medially with sparse cinereous pubescence. Elytra with three common, blackish fasciae, often extensively interrupted or reduced, the first arcuate, extending from before humerus to apical sixth of suture, second commencing on side margin just behind humerus, reaching middle of suture, and third short, confined to disk, oblique, beginning at middle laterally and continuing toward, but not attaining, suture, terminating in a large macula at apical third; and usually with a chevron-shaped blackish macula near apex, as well as a number of scattered maculae of similar color; suture and four elevated lines on disk white or pallid pubescent, finely mottled with black. Body beneath and legs ferrugineous, abdominal sternites indistinctly black apically, entirely covered with sparse ashy pubescence; femora fuscous-annulate beyond middle and sometimes with a second annulus before apex; tibiae each with two fuscous semi-annuli, one near base, the other before apex; tarsi more or less broadly fuscous-annulate apically on each segment. Antennae ferrugineous, segments broadly infuscated apically; with fuscous pubescence, each segment annulate with ashy on most of basal halves.

Upper surface densely, minutely alutaceous. Head scarcely impressed behind antennal tubercles, impunctate; front one-fifth to one-tenth wider than high, with a few setigerous punctures near eyes; eye with lower lobe oblong, erect, variable in size, ranging from slightly shorter than gena to one-fourth again as tall as it. Pronotum three-eighths to more than one-half again as wide across lateral tubercles as long, sides arcuately narrowed to apex which is subequal in width to the narrowly constricted base; lateral tubercles small, not prominent, armed with a short tooth which is directed strongly upwards; disk with three low but distinct tubercles, irregularly sprinkled with sparse, moderately fine punctures; apical sulcus visible medially, basal one abbreviated each side by the lateral tubercles. Elytra convex, basal gibbosities variable in size and prominence; each disk with four prominent, subentire costae, which do not bear tuberosities nor tufts, surface sprinkled with widely spaced, deep punctures of moderate size, more densely placed medially; apices separately broadly rounded, sometimes subtruncate at suture. Antennae one-fifth longer than body, the seventh segment attaining elytral apex, beneath with widely scattered fringing hairs on proximal segments; scape reaching to basal sulcus of pronotum, as long as or feebly longer than third segment; rest gradually decreasing in length.

Female. Like the male but metafemora attaining apex of fourth sternite, rather slender; fifth sternite subequal in length to third and fourth combined.

Length 6–11 mm.; width 2.5–4 mm.

Type localities: North America [*variegatus, obscurus*]; Alabama [*trifasciatus*].

Distribution: Eastern North America from Massachusetts west to North Dakota and south to Alabama and Texas. Massachusetts: 1, Amherst, June 6 (W.T.M. Forbes) [CU]. Connecticut: 3, Wallingford, July-Aug. (D. J. Caffrey) [CU]. New York: 1, Poughkeepsie, June 27 (H. Dietrich) [CU]; 1, Orient, Sept. (R. Latham) [CU]; 5, Ithaca, June-July [CU]; 1, Mt. Whiteface, 2000', June [CU]. New Jersey: 1, no further data [Minn.]. Maryland: 3, no further data [Minn.]. District of Columbia: 2, no further data [Minn.]. Ohio: 2, Athens, June [Minn.]; 1, Columbus, Sept. [Minn.]. Illinois: 1, no further data [Minn.]. Wisconsin: 1, Plattesville, July 8 [Minn.]. Minnesota: 2, Cass Co., July (L. W. Orr) [Minn.]; 2, Redwing (A. B. Gurney) [Minn.]; 1, Rock Co. (C. W. Oestlund) [Minn.]; 1, St. Anthony Park [Minn.]; 1, Pope Co., June 28 (C.

N. Pederson) [Minn.]; 1, Ramsey Co. (H. H. Knight) [Minn.]; 1, Norman Co. [Minn.]; 1, Itasca Park [Minn.]; 6, Luverne, June 15 [Minn.]; 1, Browne Valley, Aug. 3 [Minn.]. North Dakota: 1, Enderlin, Sept. 7 (C. Elster) [Minn.]; 1, Oakes, July 10 [Minn.]. South Dakota: 1, Black Hills, June 15–30 [Minn.]. Iowa: 5, Sioux City, June-July (C. N. Ainslee) [Minn.]; 1, Ames, June [TAM]. Missouri: 1, no further data [Minn.]; 1, St. Louis, June 29 [CU]. Texas: 3, College Station, May, June, December (H. J. Reinhard) [TAM]; 1, Mexia, Aug. 10 [TAM]. Louisiana: 1, no further data [Minn.]. Mississippi: 1, Agricultural College, Apr. 25 (Hull) [CU]. Alabama: 1, Troy, Aug. 16 [CU]; 1, Mobile, Apr. 11 [TAM]. Utah: 1, Salt Lake (C. N. Ainslee) [Minn.].

Remarks: The Utah specimen, while it may be mislabelled, is paler than any of the others and very indistinctly maculate; hence, it might prove to be subspecifically distinct.

Graphisurus Kirby

Acanthocinus (subgenus *Graphisurus*) Kirby, 1837, Fauna Bor. Amer. IV, p. 169. LeConte, 1852, Journ. Acad. Nat. Sci. Philadelphia (2)2: 174. Bates, 1864, Ann. Mag. Nat. Hist. (3)14: 13. Lacordaire, 1872, Gen. Col., IX, p. 768, 786. LeConte, 1873, Smiths. Misc. Coll., XI (265) p. 339. Provancher, 1877, Pet. Faun. Ent. Canada I, p. 629. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc., 23: 130. Wickham, 1897, Can. Ent. 29: 203. Blatchley, 1910, Col. Ind., p. 1069, 1078.

Urographis Horn, 1880, Trans. Amer. Ent. Soc. 8: 128. LeConte and Horn, 1883, Class. Col. N. Am., p. 324. Casey, 1913, Mem. Col. IV, p. 331. Knull, 1946, Bull. Ohio Biol. Surv., 39: 256.

Rather robust to robust, subdepressed, moderate-sized forms having the front of head ranging from one (*triangulifer*) to one and one-fourth times as wide as high, feebly narrowed above labrum and more strongly so between eyes; eye with lower lobe more or less oblong, feebly erect, about one-fourth again as tall as gena, upper lobe ranging from one-half as wide to as wide as upper interocular space, isthmus about four rows of facets wide. Pronotum sybcylindrical, ranging from one-seventh to one-half again as wide across tubercles as long, not at all (or only slightly) narrower at base than apically; lateral tubercles placed at basal third, low, the tooth poorly indicated or wanting; disk nearly or comparatively impunctate except in basal sulcus, without tubercles, tumid anteriorly and laterally; transverse sulci poorly defined, the basal one more distinct. Elytra subdepressed, covered, in addition to the short pubescence, with long flying hairs, without distinct costae, basal gibbosity feebly elevated, not crested; disk simply, rather coarsely punctate; apices truncate or emarginate. Prosternal process one-sixth as wide as a procoxal cavity (one-fourth as wide in *fasciatus*); mesosternal process tapering, before the reëxpanded apex about one-half as broad as a mesocoxal cavity. Fifth sternite in male one-half again as long as fourth, broadly emarginate at apex, in female as long as preceding three or four sternites together. Antennae at most one-half again as long as body in male, scarcely longer in female, beneath sparsely fimbriate on first three segments; scape slender, reaching slightly behind middle of pronotum, arcuate, not expanded apically; third segment a little longer or shorter than first, arcuate; rest gradually shorter (none of them nodulose) in both sexes.

Genotype: Cerambyx fasciatus Degeer, by original designation.

Remarks: The comparatively short antennae and the numerous long flying hairs on the elytra will serve as distinguishing characteristics.

KEY TO SPECIES

1. Antennae with third segment distinctly shorter than scape; pronotum impunctate except in basal sulcus; elytra with a common, blackish circumscutellar area . . . . . **triangulifer**
   Antennae with third segment longer than first; pronotal disk sparsely punctate, especially on basal half; elytra without a dark circumscutellar area 2
2. Elytra truncate at apex, the premedian dark fascia wanting or confined to sides; upper lobes of eyes separated by twice one of their widths; scutellum without cinereous pubescence . . . . . **despectus**
   Elytra emarginate at apex, the premedian fascia usually distinct; upper lobes of eyes separated by one and one-half times one of their widths; scutellum medially cinereous pubescent . . . . . **fasciatus**

Graphisurus triangulifer (Haldeman)

Acanthoderes triangulifer Haldeman, 1847, Trans. Amer. Philos. Soc. (2)10: 45.

Graphisurus triangulifer (Haldeman). LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia (2)2: 174. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 23: 130. Wickham, 1898, Can. Ent., 30: 39. Blatchley, 1910, Col. Ind., p. 1079, f. 465.

Urographis trinagulifera (Haldeman). Horn, 1880, Trans. Amer. Ent. Soc., 8: 128. Casey, 1913, Mem. Col., IV, p. 334. Knull, 1946, Bull. Ohio Biol. Surv., 39: 257.

Male. Piceous, elytra often dark reddish brown, densely covered with whitish or pale fulvous pubescence. Head irregularly tinged with fuscous behind and below eye. Pronotum with disk medially broadly black or fuscous margined with black, this dark area usually enclosing three or five pale maculae; sides with several small, black maculae. Scutellum entirely black, rarely very finely margined with pale fulvous. Elytra with a common triangular area at base and three or four lateral fasciae black, interrupted to a greater or lesser extent by pale maculae, the triangular area extending at sides to humeri and to basal fourth at suture, the first fascia oblique, running from behind humerus to beyond middle of disk at basal third, the second one often triangular, situated just behind middle, sometimes continued to suture, broad and not interrupted as a rule, the third fascia small, apical; the last two fasciae often outlined in part or in whole by pale

pubescence. Body beneath, legs, and antennae lead gray pubescent; abdomen with apices of sternites rather broadly shining black; femora bimaculate with fuscous above on apical halves; tibiae whitish medially, with two broad, fuscous, incomplete annuli, one near base, the other at apex, the entire inner edge lead gray; tarsi fuscous, the first segment largely cinereous pubescent; antennae with apical halves (or three-fifths) of all segments fuscous, except scape, which is fuscous only on apical fourth.

Entire upper surface minutely alutaceous and punctulate. Head with a few setigerous punctures on vertex and on frontal margin of eyes; front just as wide as high, feebly narrowed above labrum and more strongly so near antennal tubercles; eye with lower lobe oblong, slightly erect, one-fourth again as tall as gena, upper lobes separated by a distance very slightly greater than one of their widths. Pronotum one-half again as wide across tubercles as long; lateral tubercles robust, not prominent, unarmed; disk slightly tumid, not tuberculate, punctures confined to a series in the basal sulcus. Elytra rather finely or moderately coarsely punctate, the density variable from sparse to fairly dense; basal gibbosity broad, distinct, without crest; apices distinctly emarginate or subtruncate. Prosternal process one-sixth as wide as a procoxal cavity; mesosternal process tapering, before the re-expanded, emarginate apex one-half as wide as a mesocoxal cavity. Fifth sternite medially one-half as long as fourth, broadly emarginate at apex. Antennae about one-fourth again as long as body, very briefly and sparsely fimbriate beneath on first three segments, scape slender, reaching slightly beyond middle of pronotum; third segment one-seventh shorter than first, rest gradually decreasing in length.

Female. As male but fifth sternite as long as preceding three together, its apex deeply emarginate; and antennae only slightly longer than body.

Length 12–16 mm. (excluding ovipositor); width 4.3–5.3 mm.

Type locality: Alabama.

Distribution: Known to occur from Ohio and Alabama west to Texas. Ohio: 1, no further data [Minn.]. Louisiana: 1, Baton Rouge, Aug. 24, 1937 [TAM]. Texas: 1, no further data [Minn.]; 5, Mexia, July-Aug. [TAM]; 1, Austin [TAM].

Remarks: Triangulifer is quite distinct from the other members of the genus. First of all, its body form is very robust and the antennae are only a little longer than the body. Moreover, the third segment of the antennae is distinctly shorter than the first in both sexes. In addition, there is a black circumscutellar area on the elytra, the pronotum is nearly impunctate, the abdominal sternites are broadly glabrous at apex, and the ovipositor is somewhat shorter.

Graphisurus fasciatus (Degeer)

Cerambyx fasciatus Degeer, 1775, Mem. Ins., V, p. 114, f. 7.
Graphisurus fasciatus (Degeer). LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia (2)2: 175. Gahan, 1888, Trans. Amer. Ent. Soc., 15: 300. Leng and Hamilton, 1896, Trans. Amer. Ent. Soc. 23: 131. Wickham, 1878, Can. Ent., 30: 39, f. 3. Blatchley, 1910, Col. Ind., p. 1079, f. 466.
Urographis fasciata (Degeer). Horn, 1880, Trans. Amer. Ent. Soc., 8: 128. Casey, 1913, Mem. Col., IV, p. 333. Knull, 1946, Bull., Ohio Biol. Surv., 39: 256.
Lamia mixta Fabricius, 1798, Ent. Syst. Suppl., p. 144; 1804, Syst. Eleuth., II, p. 290.
Cerambyx pensylvanicus Gmelin, *in* Linne, 1790, Syst. Nat., ed. 13, I, 4, p. 1863.
Urographis fasciata reducta Casey, 1913, Mem. Col., IV, p. 333 [new syn.].

Male. Dark reddish brown, densely covered with ashy or dull fulvous pubescence, becoming whitish along elytral suture, and irregularly sprinkled with fuscous maculae as follows: Head above with a pair just behind eyes and a larger one on each antennal tubercle. Pronotum sprinkled with numerous small points and with a large macula at apex each side of middle which often extends nearly to base, sometimes a smaller similar pair of maculae opposite these at base, at other times entire central portion of disk obscure; sides below lateral tubercles at middle with a nebulous macula. Scutellum with a broad margin each side. Elytra entirely sprinkled with numerous points and with larger maculae variably congregated but usually forming a basal band or a circumscutellar, common, triangular area, two oblique angular fasciae (one at basal third often reduced to a lateral bar and one at apical third, usually darker and sometimes double, neither attaining suture), and an apical area. Body beneath and femora uniformly light gray pubescent; abdominal sternites each side with a fuscous macula; femora usually with a fuscous preapical annulus preceded by a large dorsal fuscous macula; tibiae fuscous, with a broad ashy annulus at middle; tarsi ashy pubescent, the last two segments entirely fuscous, the first two fuscous apically. Antennae sparsely fuscous pubescent, all segments except second broadly ashy annulate basally.

Entire upper surface finely, densely punctulate. Head with a few setigerous punctures around margin of eye; front about one-fifth wider than high, constricted above labrum and slightly narrowed between eyes; genae finely punctate; eye with lower lobe oblong, feebly erect, one-fourth again as tall as gena, upper lobes above separated by a distance equal to about one and one-half times their width. Pronotum about one-seventh again as wide as long, lateral tubercles low, terminating in an obtuse tuberculiform spine at apex; disk elevated apically, depressed at extreme apex, without tubercles, sprinkled with a few fine punctures and with a dense row of coarser punctures in basal sulcus. Elytra moder-

ately coarsely punctate, the punctures simple, well separated, behind middle becoming a little finer and sparser; basal gibbosity moderately prominent, without crest; apices usually distinctly emarginate, the angles acute, but sometimes nearly truncate. Prosternal process about one-fourth as wide as a procoxal cavity; mesosternal process strongly tapering, before apex less than one-half as wide as a mesocoxal cavity. Fifth sternite nearly half again as long as fourth, apex deeply, semicircularly emarginate, the lateral lobes thus produced narrowly rounded. Antennae about one-third again as long as body, with a few short setae below; scape slender, extending slightly behind middle of pronotum; third segment very slightly longer than first; fourth nine-tenths, fifth two-thirds, and sixth three-fifths as long as first; rest gradually diminishing in length.

Female. As in male but lower lobe of eye one-half again as tall as gena, the upper lobes separated by a distance only equal to their width; fifth sternite as long as rest combined, the apex deeply triangularly notched, the lateral lobes arcuate; last tergite with a longitudinal median costa or sulcus.

Length 8.5–13 (excluding ovipositor) mm.; width 3–4 mm.

Type localities: Pennsylvania [*fasciatus; pensylvanicus*]; North America [*mixta*]; West Point, New York [*reducta*].

Distribution: Southeastern Canada and the eastern half of the United States west to Kansas and Texas, rarer in the South. Ontario: 2, Toronto [CU]. Massachusetts: 5, Cohasset, June-July [CU]. Connecticut: 5, Cornwell, June 6, [CU]. New York: 30, Ithaca, June-Aug. [CU]; 8, Olcott [CU]; 7, Tarrytown, bred from elm [CU]; 9, Yonkers, from elm [CU]; 2, Penn Yan [CU]. Pennsylvania: 8, Allegheny Co., June-July [CU]. New Jersey: 1, High Point, July [CU]; 1, Ridgewood, Sept. [CU]; Maryland: 6, no further data [Minn.]; 1, Odenton, July [CU]; 1, Edgewood, Oct. [CU]. Virginia: 3, no further data [Minn.]; 1, Leesburg [CU]. North Carolina: 1, no further data [Minn.]. Florida: 1, Winter Park, March [CU]. Ohio: 2, Athens Co. [Minn.]. Wisconsin: 3, Bayfield [CU]. Minnesota: 4, Eitzen, June [Minn.]; 1, Spring Valley, July [Minn.]; 1, Otter Lake [Minn.]; 8, Anoka Co. [Minn.]; 6, Olmstead Co. [Minn.]; 1, Houston Co., May [Minn.]; 1, Washington Co. [Minn.]; 3, Excelsior, under oak bark [Minn.]; 1, Blue Earth Co. [Minn.]; 3, St. Paul, [Minn.]; 5, St. Anthony Park [Minn.]; 1, Rainey Lake [Minn.]. Kansas: 1, Douglas Co. [CU]. Tennessee: 1, no further data]CU]. Arkansas: 2, Hope, June, Oct. [CU]. Mississippi: 5, Lucedale, March-May [CU]; 1, State Line, June 4 (H. Dietrich) [CU]; 1, Oxford, June [CU]. Texas: 2, Mexia [TAM]; 1, Tyler, Aug. [TAM].

Graphisurus despectus (LeConte)

Aedilis despectus LeConte, 1850, *in* Agassiz, Lake Superior, p. 234.
Graphisurus pusillus Kirby. LeConte, 1852, Jour. Acad. Nat. Sci. Philadelphia, (2)2: 175 [misdet.].
Urographis hebes Casey, 1913, Mem. Col. IV, p. 333. Knull, 1946, Bull. Ohio Biol. Surv., 39: 257, f. 104. [new syn.].
Graphisurus hebes (Casey). Craighead, 1923, Dom. Can. Agr. Bull., 27: 121.

Male. Very similar in appearance and structure to *G. fasciatus* DeGeer, but differs from it as follows: Pubescence generally pale gray, rarely fulvous, less densely sprinkled with fuscous maculae. Head with the fuscous maculae of vertex extending forward between eyes; maculae on antennal tubercles small, less distinct. Pronotum with median discal maculae narrower, often reduced and not vittiform; sides below lateral tubercle lacking a large macula medially. Scutellum entirely fuscous pubescent. Elytra without large maculae at base, the fascia at basal third always reduced to a short bar on sides, the one on apical third sharply defined, never double. Abdominal sternites without lateral fuscous maculae; femora with fuscous markings lacking or reduced in size, only the metafemora ever with a preapical annulus.

Head with front one-fourth again as wide as high; eye with lower lobe nearly one-third again as tall as gena, the upper lobes separated by almost twice their widths. Pronotum one-third again as wide as long, the spine of lateral tubercle reduced in size, often wanting. Elytra with apices broadly, obliquely truncate. Prosternal process one-fifth to one-seventh as broad as a procoxal cavity. Fifth sternite only slightly longer than fourth, its apex not so broadly nor so deeply emarginate, the lateral lobes broadly rounded. Antennae more than one-half again as long as body; third segment one-tenth longer than first; fourth equal to first; fifth one-eighth and sixth one-fourth shorter than first.

Female. As in male, but eye with lower lobe nearly twice as tall as gena, upper lobes separated by a distance equal to one and one-half times their width; fifth sternite not so long as rest together, its apex subsemicircularly emarginate; last tergite without a median costa or sulcus.

Length 8.5–13 mm. (exclusive of ovipositor); width 2.8–4 mm.

Type localities: Lake Superior [*despectus*]; Iowa and New York [*hebes*.].

Distribution: Entire eastern half of the United States. No locality data: 4, [CU]. Connecticut: 2, Cornwall, June [CU]. Pennsylvania: 3, Allegheny Co., July 3, (E. A. Klages) [CU]; 2, Hummelstown, July (Knull) [Minn.]. Virginia: 1, Cape Charles, June [Minn.]. Illinois: 1, Evanston, June 11, on hickory [CU]; 3, Rock Island [Minn.]. Minnesota: 1, Olmstead Co. [Minn.]; 7, Hennepin Co., May [Minn.]. Missis-

sippi: 1, Agricultural College, Mar. 30, 1921 [CU].

Remarks: Since LeConte described *despectus* as having truncate elytral apices and as having only one or two dark maculae on the femora, it seems certain that this was the insect he had before him. These characters and the entirely dark scutellum will separate this form from *fasciatus*, as well as the characters of the fifth sternite.

Sternidocinus Dillon, gen. nov.

Moderate-sized, elongate-oblong, subcylindrical beetles. Head with a few setigerous punctures near margin of eye, otherwise impunctate, vertex somewhat impressed medially behind antennal tubercles; front scarcely transverse, strongly narrowed above eyes, gradually so below, very slightly convex in male, planate or subconcave in female; mouthparts in the same plane as front; eye with lower lobe oblong, erect, two-thirds as tall as gena, upper lobes less than half as wide as interocular space. Pronotum very strongly transverse, nearly twice as wide across lateral tubercles as long, sides subparallel, feebly constricted before base; lateral tubercles placed very slightly behind middle, large, prominent, briefly armed at apex; disk not tuberculate, tumid each side, longitudinally impressed at middle; apical as well as basal transverse sulcus distinct, straight, the former close to apex and deep so that the apical margin appears elevated as a consequence. Elytra parallel-sided, finely, densely punctate; basal gibbosity moderately prominent; disk with four costae, which bear low tufts but no tubercles; apices separately broadly rounded or subtruncate. Prosternal process one-sixth as broad as a procoxal cavity, simple; mesosternal process tapering, broadly truncate at apex, about two-fifths as broad as a mesocoxal cavity; fifth sternite slightly longer than fourth in male, equal to third and fourth together in female. Femora robust, strongly clavate in both sexes, metafemora somewhat more slender, especially in female, extending to apex of fourth sternite in female, to base of fifth in male; protibiae in male denticulate near apex on inner surface. Antennae one-third longer than body in male, one-sixth longer than body in female, with one or two long fringing hairs beneath on first two segments; scape attaining basal third of pronotum, first, third, and fourth segments subequal in length, rest gradually shorter.

Genotype: Liopus barbarus Van Dyke.

Remarks: In body form, shape of lower ocular lobe, form of front, parallel-sided elytra, and narrow prosternal process, this genus approaches *Neacanthocinus* and related genera. However, it is distinct from all of these in the antennal formula, in the fairly broad mesosternal process, in the marked sexual differences in the front, and in the denticulate protibiae of the male.

Sternidocinus barbarus (Van Dyke)

Liopus barbarus Van Dyke, 1920, Bull. Brooklyn Ent. Soc. 15: 45.

Male. Dark reddish brown, densely covered with ashy pubescence, strongly tinged with brown on head above, on pronotal disk, and irregularly on elytra. Pronotum on disk with an indistinct, interrupted, broad, fuscous vitta each side, often somewhat more distinct on basal half. Scutellum broadly margined with dark brown on each side. Elytra mottled with fine dark brown maculae, which are denser at base and arranged in more or less distinct rows on apical two-thirds; with three common, W-shaped, fuscous markings, one just before middle, one before apical third, and the last near apex, often somewhat interrupted medially, each preceded by a patch of denser ashy pubescence. Femora above near apex, and tibiae near base and at apex maculate with dark brown; tarsi broadly fuscous annulate on apex of each segment. Antennae broadly fuscous annulate on apex of each segment, the annulus on first four segments interrupted below.

Head above scarcely impressed behind antennal tubercles, impunctate; front very feebly wider than high, strongly narrowed below antennal tubercles, gradually so below eyes, very slightly convex; eye with lower lobe more than one-third shorter than gena, oblong, erect, upper lobe less than half as wide as interocular space. Pronotum four-fifths again as wide across lateral tubercles as long, sides subparallel, feebly constricted before base; lateral tubercles large, prominent, with a short tooth at apex; disk not tuberculate but with a broad tumescence occupying most of sides, leaving an elongate depressed area at middle, rather finely, densely punctate; apical and basal transverse sulci distinct, straight, the former set so close to margin as to cause the apical rim to appear elevated. Elytra finely, densely punctate; basal gibbosity moderately prominent; each disk with four distinct costae, which bear numerous tufts but no tubercles; apices separately broadly rounded or subtruncate. Femora strongly clavate, the metafemora not quite so strongly thickened as mesofemora, extending to base of fifth sternite; protibiae on inner surface before apex with a curved, acute denticel. Antennae one-third again as long as body, with a single fringing hair on apex of first and of second segment; scape attaining basal third of pronotum; third segment and fourth segments each subequal to first; rest gradually decreasing in length.

Female. Front planate or subconcave; protibiae unarmed; metafemora rather slender, attaining apex of fourth sternite; fifth sternite subequal to third and fourth combined; antennae only one-sixth longer than body; otherwise as in male.

Length 11.5–13.5 mm.; width 3.2–4.3 mm.

Type locality: Carpenteria, Santa Barbara Co., California.

Distribution: Known only from southern California. California: 1, Carpenteria, May 1, 1929 (Muzzal) [CAS]; 2, Ventura, May 27, 1926, from live oak [KU]; 1, Santa Cruz Island [CU]; 1, Saticoy, July 10, 1926 (S. E. Flanders) [CAS].

Remarks: In coloration, this species recalls *Astyleiopus variegatus* and certain species of *Eutrichillus* but differs in the form of the eye and of the pronotum, as well as in lacking long hairs on the elytra. It is especially remarkable for the pronounced sexual dimorphism of front and protibiae.

STUDIES ON THE COPULATORY AND EGG-LAYING HABITS OF HIEROGLYPHUS NIGROREPLETUS BOL. (ORTHOPTERA, ACRIDIDAE)[1]

P. D. SRIVASTAVA

Research Assistant, Zoological Research Laboratories, University of Allahabad, India

INTRODUCTION

Hieroglyphus nigrorepletus, a common Indian acridid, is one of the serious pests of *Andropogon sorghum*, *Pennisetum typhoideum*, and *Saccharum officinale*. In view of the fact that some work has already been done on the breeding habits of this grasshopper, by Roonwal (1945), only copulatory and egg-laying habits have been dealt with in detail in this paper.

Adults and nymphs of *H. nigrorepletus* (brachypterous form) were obtained mainly from *juar* (*Andropogon sorghum*) fields. They were also reared from the egg pods collected from the fields soon after the first showers of rain towards the end of June as well as from the eggs laid by the females in the laboratory.

COPULATION

Copulation was noted in six pairs and was found to be similar in all of them in practically all its details except for the timing and duration as indicated in Table I.

It was observed that the courting activity is at its maximum in September and part of October, and that the male is the active individual. The present observations are in agreement with those of Turner (1916) on other Acrididae. When a male notices a female, he takes a place and position suitable for jumping upon her. After mounting the female, he adjusts his position so as to maintain the hold over her, with the help of the first and second pair of legs. The first pair is used to hold back the pronotum and the second to grip the side of the abdomen near the third pair of coxae. The third pair of legs is not used at all in the process and remains free.

The male, after having secured his position upon the body of the female, bends his abdomen to the right or left in order to bring his copulatory apparatus in contact with the ovipositor valves of the female. Then he gives the abdomen a spiral twist, protruding at the same time the copulatory apparatus for insertion between the anterior and posterior pair of ovipositor valves. This insertion is more usually from the left side although insertions from the right side also have been noticed. During the act of insertion no part of the body is damaged. The copulatory apparatus is thus protruded from the last segment of the male and is inserted between the upper (anterior) and lower (posterior) ovipositor valves of the female. The present observations are in agreement with those of Turner (1916), Federov (1927) and Uvarov (1928) in Acrididae.

TABLE I

DURATION OF COPULATION IN *Hieroglyphus nigrorepletus*

DATE	TIME WHEN COPULATION STARTED	TIME WHEN COPULATION WAS COMPLETED	TOTAL TIME TAKEN IN COPULATION	
			Hrs.	Mins.
16/ix/'51	1.15 P.M.	5.10 P.M.	3	55
20/ix/'51	12.30 P.M.	3.30 P.M.	3	0
25/ix/'51	8.30 A.M.	2.30 P.M.	6	0
25/ix/'51	9.45 A.M.	1.05 P.M.	3	20
2/x/'51	8.10 A.M.	12.50 P.M.	4	40
10/x/'51	9.05 A.M.	2.50 P.M.	5	45

During copulation the antennae of the male are kept stretched at an angle of a little more than 90° with the head, but are occasionally used to touch the head and the pronotum of the male.

During the act, feeding is suspended completely but the female keeps on passing faeces at short intervals.

If allowed to proceed undisturbed, the male

[1]The work formed a part of the thesis submitted for the degree of Doctor of Philosophy in Zoology in 1952, at the University of Allahabad.

Date of acceptance, Dec. 7, 1954.

remains practically quiet except for the movements of the antennae noted above. The female however, sometimes moves about slowly with the male over her and occasionally kicks him with the tibiae of the third pair of legs. The frequency of these kicks increases after the copulation has progressed for three to six hours, indicating that the copulation is complete and she desires to dislodge the male from her body. Federov (1927) also has observed similar movements of hind legs in females of *Anacridium aegyptium* towards the end of copulation. If disturbed, the female takes a few strides and sometimes the copulation ceases even before the act is complete.

Federov (1927) mentions the minimum period of copulation to be eighteen hours in case of *A. aegyptium*. But in the present case pairs remain *in copula* only from 3 to 6 hours even if left entirely undisturbed (Table I). This wide variation, in the opinion of Uvarov (1928) is due to difference in the process of formation of spermatophores. Thus where only one spermatophore is formed and transferred at a time, pairing is of short duration, but where more than one spermatophore is formed and all are to be transferred simultaneously the period of duration of copulation is naturally prolonged. In this Egyptian grasshopper, copulation lasts from eighteen to sixty hours, and six to thirty spermatophores are formed (Federov 1927). The natural conclusion is that in *H. nigrorepletus* the number of spermatophores passed during copulation is comparatively small; *i.e.* even less than six.

Copulation in *A. aegyptium* takes place more often on the ground and seldom on the branches of trees and it begins in the morning. In *Melanoplus femur-rubrum* the red-legged, and *M. bivittatus* the two-striped grasshopper, it takes place on the herbage-covered ground as noted by Tutt (1905). Turner (1916) observed the mating pairs of Acrididae (Locustidae) upon parallel or diverging stems and also upon the ground in horizontal position.

In the present case the author has observed pairing upon the leaves of host plants as well as on the ground. It begins on the leaves in the morning and after the heat of sun becomes intense, the mating pairs shift to more shady places on the ground. In this case also as in *A. aegyptium* copulation starts usually in the morning but it may start in any other part of the day as well. In any case the copulating pairs separate before dusk. All this goes to show that the place of copulation is the natural abode or the place of main activity of the insect, and the time of mating is the time when the insect is most active. This fact is of significance to the field entomologist, for the most suitable time to adopt control measures against this insect should be the time of its maximum activity, particularly the mating activity, during which period the mating pair is usually not easily disturbed.

It has been noted that the male nymph of the fifth stage attempts to copulate with the female nymph of the same stage in the same manner as the adult male, but without success. The female offers resistance to such an attempt of the male and either the riding nymph is soon dislodged by the female or he himself gets down after an unsuccessful attempt. With the amount of resistance offered by the female, it seems more probable that the male gonads mature earlier than the female ones. This fact was actually confirmed by dissection.

OVIPOSITION

Observations on the oviposition of six females were made, but only three cases are described here as the remaining ones were exactly similar to the first.

A female was seen extending her abdomen and moving her anterior and posterior valves so as to close and open the gap between them. It appeared that she was in search of some suitable place to lay eggs. Then suddenly a whitish yellow exudation was noticed at the posterior end of the abdomen. On being removed to a rearing bottle $6\frac{1}{2}''$ x $2\frac{1}{4}''$ with garden soil $3''$ deep in it, she started drilling a hole, but after ten minutes she stopped doing so, began feeding and took out her abdomen from the uncompleted hole. Then again she stopped feeding and commenced drilling another hole near the sides of the glass obliquely. This hole on completion was about $2''$ deep and about $0.2''$ in diameter.

In this hole was first poured out a mass of froth to form a layer at the bottom and the sides, then one egg followed with a little froth. More eggs and froth followed in quick succession until the egg laying was completed and the hole finally sealed with froth to cover the eggs. As the process of egg laying proceeded she gradually retracted her abdomen from the hole. The frothy mass was whitish yellow when fresh but gradually turned brownish. The yellow eggs also turned deep brown within half an hour after oviposition. Finally the exudation of the froth stopped, but the grasshopper remained quiet, keeping the posterior one-third of her abdomen inside the hole. She remained sitting in this position for about forty minutes, then with a sudden jerk retracted her abdomen completely and jumped onto the lid of the bottle. There she remained sitting for an hour, after which she descended and sat near the hole in which she had laid the eggs.

The search for a suitable place for egg laying started at 4:30 P.M. and the retraction of the abdomen from the hole was completed at 7:10 P.M., the entire process thus taking about two and a half hours.

Another female which had already copulated was observed to be very restless. She moved about in the cage, extending and contracting the

abdomen and moving the ovipositor valves briskly. This happened at 12:15 P.M. The female was shifted to a rearing bottle with soil 3″ deep in it. After moving about for a short while in the bottle, strangely enough, the female started laying the eggs on the surface of the soil and did not make any attempt to dig a hole for egg-laying. The soil provided in this particular bottle was ordinary garden soil as was used for other egg-laying experiments.

She started giving out froth at 12:20 P.M. and continued doing so for 15 minutes, till 12:35 P.M. when the first egg was laid. The egg-laying continued till 1:25 P.M., during which period of fifty minutes she laid fifty-five eggs in all. The size, shape and colour of these eggs were similar to those laid by other females inside the holes in the soil.

The time interval between the exudation of the froth and the eggs was longer in the beginning, but it went on decreasing along with the time interval between succession of the eggs laid.

In another instance a female kept in a bottle without soil was found to lay forty eggs at its bottom. The eggs in all the cases were cylindrical and whitish yellow when laid, turning deep brown later on, each measuring about 4.8 mm. in length and about 1.2 mm. in diameter. The eggs, even in the second and third case, were found to be fully developed and, as the eggs were laid by females which had already copulated they must also have been fertilized, although, as expected, none of them hatched.

Uvarov (1928) says that most Acrididae lay eggs in the ground, the choice of the soil being based upon its physical properties and humidity and differing in different forms. Liu and Li (1933) and Isely (1944) agree with Uvarov.

The preoviposition restlessness and movements of females and of their ovipositor valves show that *Hieroglyphus nigrorepletus* females look for a suitable place for oviposition like the females of the other species. In the first instance described here oviposition was normal. In the second, by the time the female was removed to a separate bottle with soil, a state had already been reached where egg-laying could not be postponed any further. In the third instance there was no possibility of digging a hole. Lal (1941) records a swarm of *Schistocerca gregaria* Forsk. "dropping eggs on a tract of wasteland" without boring any holes. A similar phenomenon was also observed in Alwar (Lal, 1941), where "a swarm resting on trees simply threw down their eggs". According to Lal (1941), one of the causes of this unusual phenomenon is "extreme dryness" which is ruled out from the present observation where the soil was moist and soft and where, in similar soils, other females did lay eggs by boring holes. So obviously it is not the "extreme dryness" which prevented the locusts from boring holes for egg-laying, but the particular state of readiness. All these observations show that the actual oviposition is not merely a reflex brought about by some stimulus which acts only when the hole is ready for egg-laying, but by some internal physiological condition; and as soon as this particular physiological state of readiness for oviposition is reached the female cannot postpone egg-laying for any considerable length of time or for the availability of a particular external condition. She must start laying the eggs in whatever circumstances she finds herself. Uvarov (1928) has noted that when the hole is ready, eggs start coming out automatically. This is perhaps due only to a synchronization between the ready physiological state and the available suitable external condition and is due to the fact that under normal conditions digging of the hole is started in time and completed at an almost proper moment for oviposition.

The reproductive activity is at its maximum during September and part of October, in nature as well as in captivity. This is possibly due to their exposure to bright sun, after rains.

During the normal life-history light is helpful to the emergence of vermiform larvae. It has been observed that the egg pods of *Hieroglyphus nigrorepletus* dug out of the soil and brought to light during the monsoon months, invariably hatch soon after being exposed to light. Obviously the temperature under the soil is not likely to be markedly lower than that of air and therefore this action seems entirely to be due to light.

SUMMARY

Copulation in *Hieroglyphus nigrorepletus* begins usually in the morning and lasts from 3 to 6 hours. The male nymph of the fifth stage also may attempt unsuccessfully to copulate with the female nymph of the same stage.

Hieroglyphus nigrorepletus, like other grasshoppers, is typically a soil ovipositing grasshopper. The female digs a hole about 2″ deep and about 0.2″ in diameter. The number of eggs laid by a female varies from 40 to 55. The female, however, under unusual circumstances oviposits even without digging a hole. The reproductive activity is at its maximum in September and part of October.

Light has been found to be helpful in the emergence of vermiform larvae from the eggs.

ACKNOWLEDGMENT

The author expresses his deep sense of gratitude to Shri S.C. Verma, Reader in Zoology, University of Allahabad, under whose guidance the work was carried out in the Zoological Research Laboratories of the University of Allahabad.

REFERENCES CITED

Federov, S. M. 1927. Studies in the copulation and oviposition of *Anacridium aegyptium* L. (Orth. Acridi.). Trans. Ent. Soc. London 75: 53–60.

Isely, D. 1944. Methods of Insect Control. Part II. Burgess Publish. Co. Pp. 115–21.
Lal, K. B. 1941. An unusual mode of oviposition in the desert locust. Indian Jour. Ent. 3(2): 339.
Liu, Chi-Ying and **Li, Shou Sing.** 1933. Some preliminary notes on the life history of rice grasshopper *Oxya chinensis* Thunberg. (with English Summary) Year book Bur. Ent. Hangchow China 1932, pp. 59–70.
Roonwal, M. L. 1945. Notes on the bionomics of *Hieroglyphus nigroreplétus* Bolivar (Orthoptera, Acrididae) at Benares United Provinces, India. Bull. Ent. Res. 36(3): 339–41.
Turner, C. L. 1916. Breeding habits of the Orthoptera. Ann. Ent. Soc. Amer. 9: 117–35.
Tutt, J. W. 1905. Observations on the pairing of grasshoppers. Ent. Rec. 17: 95–6.
Uvarov, B. P. 1928. Locusts and grasshoppers. Imperial Bur. Ent., London.

NOTES ON THE LIFE HISTORY OF SEVEN SPECIES OF ANTHONOMUS OCCURRING IN ILLINOIS (CURCULIONIDAE, COLEOPTERA)[1]

DONALD M. TUTTLE[2]
Department of Entomology, University of Illinois, Urbana

This paper is part of an extended study on the bionomics of Curculionidae in East Central Illinois, chiefly in Champaign County. Particular reference to plant host associations are brought out for seven species of *Anthonomus*.[3]

Most species of *Anthonomus* inhabit the buds, flowers, fruit and seed of the plants. Pupation takes place within the feeding cell of the larva. A few species have been associated with the galls of plants. The most widely known and studied species of this group has been the cotton boll weevil. Its life history is typical for the genus. All of the species investigated in Illinois were associated with the floral parts and two species, *suturalis* and *elongatus*, seem to have some relationship with galls.

Members of this group are small to moderate in size, measuring from 1.5 to 8 mm. long. The snout is usually long and slender with antennal grooves directed toward the eyes. The funicle of the antennae are 6- or 7-segmented with an elongate-ovate club. Most species have striated and punctured elytra which are rounded apically leaving the pygidium exposed. The femora are generally toothed and the tibiae of the front and middle legs have a hook. Like most weevils the beak of the male is shorter, less shiny and more coarsely sculptured with punctures and striations than the female. The males are slightly smaller.

[1]Contribution from the Department of Entomology, University of Illinois, Urbana, Illinois. This paper represents a part of a thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Entomology. Accepted for publication May 11, 1955.

[2]At present Research Entomologist at the University of Arizona, Tucson, Arizona.

[3]The author is indebted to the following specialists of the Entomology Research Branch, Agric. Res. Service, USDA for identifications of weevils and parasites: W. H. Anderson, R. E. Warner, C. F. W. Muesebeck and B. D. Burks.

Anthonomus albopilosus Dietz

This species has been reported from California, Texas, Louisiana, Arkansas, Illinois and Mexico. In southern Illinois this species was collected in the following counties: Greene, Union, Maucopin, St. Clair, Franklin, Christian and Madison.

A. albopilosus appears to be limited to *Croton* spp. Larvae, pupae, and adults were dissected from the seeds of *Croton capitatus* in Illinois. This species of *Croton* was abundant along fence rows and in cornfields throughout southern Illinois in 1951. Pierce (1907) gives *Croton capitatus*, *C. engelmanni*, and probably *C. texense* as host plants.

Adults are abundant in the fall, feeding on the leaves and terminal parts of the host plant. Specimens taken in Illinois indicate the adults appear September 1 to October 16. Pierce (1908) writes that it inhabits *Croton* from August 26 to September 29 in Louisiana.

No observations were made concerning egg-laying other than the fact that the scar of the egg-laying site is evident from the exterior and more so on the inner surface of the seed pod.

Several larvae were found in the seed capsules from September 10 to 30, 1951. Pierce (1907) found that a larva eats out one or two seeds and pupates in a second or third seed. The larval period does not appear to be more than three weeks, according to field observations in Illinois.

Pupae were observed in Louisiana on August 26 by Pierce (1916). This stage was not found in Illinois until the middle of September.

From larvae of *A. albopilosus* collected in 1951, three adults of the parasite, *Calolaccus incertus* Ashm., family Pteromalidae, were reared. Two other species of parasites were reared by Pierce (1907): an encyrtid, *Cerambycobius cyaniceps* Ashm., *family Encyrtidae* and a braçonid, *Bracon mellitor* Say.

Anthonomous albopilosus appears to be strictly

a fall species which completes its developmental period, egg to adult, in approximately one month.

Anthonomus suturalis Lec

Anthonomus suturalis occurs throughout Canada, New England, and the southern, middle and western states. At Charleston, Illinois, fifteen specimens were collected from the leaves of hickory.

The author discovered a number of these weevils running over the surface of the leaves of two species of hickory, *Carya ovata* and *C. laciniosa*, and observed that they were paying particular attention to aphid galls on the underside of the leaves. Walsh (1886) reported this weevil's association with galls on *Crataegus crusgalli*. He made some observations and took specimens in various stages of development from cecidomyidous galls, *Crataegi plica*. It seems quite likely that they are inquilines of various species of aphid and dipterous galls. Ulke (1902) reported it on wild plum, *Prunus*, sp., and Lugger (1889) found that they breed in the bud and fruit of cranberry. Later Hardenberg (1908) in Wisconsin, and Franklin (1915) in Massachusetts, made further observations of injury to cranberries by this weevil.

On May 12, 1951, 15 adults were collected on the surface of hickory leaves. The weevils were easily collected by holding a killing jar under the leaf and tapping the upper surface. Like many of the snout beetles, this species feigns death by retracting its appendages and dropping to the ground.

A few mating pairs were observed on May 12, 1951. In the case of cranberries, an egg is placed in a developing bud and the peduncle is punctured afterwards, so that, further development of the bud is checked. (Lugger, 1889.) Hardenberg (1908) has observed oviposition of this species in cranberries in Wisconsin and also states that the beetle drills a hole into the bud and lays an egg before puncturing the peduncle. The pale yellow eggs are subspherical in outline. In a few days the bud falls off or may remain on the plant during the development of the weevil. Within the bud the egg hatches and the whitish larva with a brownish head feeds on the internal parts, especially the pollen. The larva consumes the contents of the bud, leaving only frass. Upon opening half decayed buds, Hardenberg (1908) found larvae or other stages of this weevil. Apparently, it makes little difference to the developing larvae whether the buds remain on the plant or fall to the ground. The larval period is short and the larvae feed on the decaying floral parts. When mature, the larva undergoes transformation, in the bud, into the pupal stage. The fully developed adult eats its way out of the brown bud (Hardenberg, 1908).

Existing information indicates there are two different types of places in which this species is able to develop. Specimens observed, collected and identified in Illinois were associated with hickory galls. On the other hand, it is also reported by other workers as inhabiting cranberries. It would seem that there should be some specific difference in these two types. In Illinois the petiole of hickory leaves were punctured by an insect which seems to be a weevil. Eggs and larvae of the first and second instars which were removed may be those of *A. suturalis*. In August petioles with exit holes of irregular shapes were frequently found. It is possible that *A. suturalis* inhabits the petioles, but on the other hand, it may be another species of snout beetle. Further observations and investigations of hickory leaves will be necessary to learn the life histories of insects inhabiting the petioles of hickory.

Anthonomus nigrinus Boh. (Potato Bud Weevil)

Blatchley and Leng (1916) give the range of the potato bud weevil from New York, Maryland and Indiana to Louisiana. It occurs in several counties throughout the state of Illinois.

The potato bud weevil commonly breeds in horse-nettle, *Solanum carolinense*. It was abundant on this plant in Illinois. Chittenden (1895, 1897) gave this weevil its common name because of the damage it inflicts upon the buds of potato. Another plant which he lists as a host plant is the egg-plant, *Solanum melongena*. It seems possible that other solanaceous plants may serve as host plants.

In Illinois the adults of this species occurred from June 6 to September 1, which corresponds to other records. Activity of the weevils seems to be simultaneous with the maturing of the buds of horse-nettle. At Mahomet, Illinois, adults were observed feeding and mating on the terminal leaves, flower buds, and the developing fruit of horse-nettle. Many of the leaves appeared riddled as a result of the feeding of the adults. The majority of holes are quite irregular in outline and rarely exceed 3.0 mm. in diameter. While copulation was more common during June, it was also observed in July and August.

Flower buds of horse-nettle were attacked about the time they reached maturity. Sometimes the author found rather small buds which had been utilized for oviposition by the female. Females were observed eating holes into the buds, then turning around and going through the motions of laying an egg. These apertures are usually near the center of the elongate bud. Apparently the egg is placed between the anthers.

Chittenden (1895) thought that this species was nocturnal in habit. He usually found the adults hidden in the terminal part of the plant during the day and never witnessed mating or oviposition. Since the present author observed copulation and oviposition during the afternoon, he cannot agree with this supposition.

The larva creates a cavity within the elongate bud by eating the pollen and other floral parts. Usually there is only one larva in each bud but as many as three may occur. An axillary septum divides the bud into four chambers or cavities. By feeding on the essential floral parts, the larva prevents the bud from opening and thus makes a place where it can complete its development. Frequently a large irregular hole is eaten through the corolla by the larva. It is a convenient opening through which development may be watched. In Illinois, mature larvae were found up to August 4. Because blossoms of this plant may be found from June to September, it is likely that the larvae of this weevil may occur during most of this time.

Pupae were obtained in July and as late as August 4. Newly transformed pupae found on August 4 reached the adult stage on August 12 and 13; in other words, 8 to 9 days were passed in the pupal stage. Chittenden (1895) found pupae from June 29 to July 18, and new adults began emerging July 2. This indicated the pupal period may be as brief as 5 days.

Chittenden (1895) reared three species of parasites from the potato bud weevil. Two of these were chalcids which were identified by Ashmead as *Catolaccus anthonomi* Ashm. and *Entedon lithocolletidis* Ashm. The other was a braconid doubtfully determined as *Phanerotoma tibialis* Rald. Another species of parasite, *Catolaccus incertus* Ashm. was reared by Pierce (1907). The buds which he collected on July 3 yielded 110 weevils in various stages, of which 18 or 16.2 percent were parasited.

Anthonomus rufipes Lec.

This species is distributed in New York, Iowa and Delaware (Blatchley and Leng, 1916). During the autumns of 1950 and 1951 it was frequently found in Illinois. The first Illinois record was by Dr. Hamilton and the first Iowa record by A. Bolter (Dietz, 1891). LeConte had a single specimen from New York at the time he wrote the description of this species (Dietz, 1891).

No record of a plant host for this species appears throughout literature so far as is known. In 1950, the writer found this weevil breeding abundantly in the flower heads of the New England aster, *Aster novae-angliae*. On September 15, larvae, pupae, and adults were dissected from the flower heads of this plant. All the floral parts except the receptacle and pappus was consumed by the larvae.

Records of the author show that adults were collected from June 15 to October 5. Since most of these records are near those two dates it is possible that *A. rufipes* does not appear continuously through the above period. However, Blatchley and Leng (1916) had adults taken near New York City on July 25. The newly transformed adults are white but attain their characteristic brown colors in twenty-four hours. They may remain in the flower bud a day or two before they eat their way out. The exit or hole for emergence is made near the bottom and toward the side of the flower head.

Only a few mature larvae were found on September 15, as most of them had already transformed into the pupal stage. These yellowish larvae measured 1.5 mm. long and rested in a coiled position. There is only one larva in each flower head. Obviously, the food supply is ample for the development of only a single larva. The larva devours all the seeds, leaving only the pappus and the receptacle of the flower. Either the plant or the larvae, or perhaps both, exude a somewhat sticky material that has a tendency to hold the pappus of the seed together sufficiently so as to afford the larva protection during its development.

The pupa lies in a brownish chamber whose interior is suprisingly smooth. Newly transformed pupae are white in color and very active. Observations in the laboratory indicate the pupal period requires 7 to 8 days. About the fifth day the appendages became darker and on the seventh or eighth day the pupa looks very much like the adult. Another curious fact discovered while dissecting seed capsules was that the pupae usually rest in a vertical position with their heads downward.

Anthonomus rufipennis Lec.

Blatchley and Leng (1916) state this species ranges from New England and Canada to Wisconsin, south to Florida and Texas. The three specimens taken by the writer were collected at Muncie, Illinois. It was described by LeConte (1876) from Pennsylvania and he also recorded Illinois, Texas, and Florida as states in which it occurs. Other records are Arkansas (Pierce, 1907), and Indiana, New Jersey, and Florida (Blatchley and Leng, 1916).

The three specimens collected at Muncie, Illinois were on the leaves of the sandbar willow, *Salix interior*. Earlier Pierce (1907) refers to J. D. Mitchell who collected numbers of this species on *Cassida chamaecrista* at MacNab, Arkansas.

The writer obtained one specimen May 19 and two specimens May 24 on the leaves of sandbar willow.

Apparently little is known about this weevil. Even the host associations are not conclusive.

Anthonomus nubiloides Fall

Anthonomus nubiloides was abundant wherever the host plants occurred in Illinois. During 1950 and 1951, the author reared this species from the flower buds of two species of St. John's-wort, *Hypericum sphaero-carpum* and *H. punctatum*. St. John's-wort occurs frequently along

the railroad tracks near Urbana, Illinois. This species was collected in large numbers from June 17 to August 30 in Illinois.

Mating and ovipositing was observed from June 17 to July 15. Males attach themselves to females for 10 to 15 minutes at a time. Usually the mating pairs are found on the flower but occasionally in the axils of the terminal leaves. Eggs are placed within the developing seed capsules. Small dark wounds which are a result of the female puncturing through the seed capsule are easily discernible.

The development of this weevil within the seed capsule requires about one month. It seems probable that the adult hibernates and that there is a single generation each year. The developing larvae eat out the immature seeds within the seed capsule. Only one larva per seed capsule was found in the one hundred or more capsules which were dissected. The capsules turn brownish and appear to be slightly smaller than those not occupied. Upon opening a capsule, the presence of a larva can be easily determined by the frass. The larvae go from seed to seed, consuming most of the four to six seeds in each capsule. Larvae are mature about August 1. Pupation takes place within the seed capsule. The developing pupae are grayish in color and vibrate the abdomen rapidly when disturbed. They are able to move about in the seed pod by abdominal movements, aided by the short spines at the end of the abdomen.

Dr. B. D. Burks identified 11 females and 6 males which the author reared from the larvae of this curculio as *Zatropis perdubius* (Gir.), family Pteromalidae. Most of the adult parasites emerged August 22 to August 28 in the laboratory. From dissections of the seed capsules it appears that approximately ten percent of the larvae of the weevils had been parasitized.

Anthonomus elongatus Lec.

Anthonomus elongatus ranges from Quebec and New England to Nevada and south to Florida (Blatchley and Leng, 1916). In Illinois several specimens were obtained east of Urbana.

All of the specimens which were obtained in Illinois occurred on the flowers of *Prunus serotina*. Frost (1908) also recorded finding them on *Prunus*. An interesting case is reported by Schwarz (1884), who found this species breeding in twig galls on *Bigelovia*.

The specimens collected by the author from Illinois were taken May 30 to June 23. Blatchley and Leng (1916) write that it occurs occasionally from May 12 to June 11 in Indiana. They also give records of March 12 from New York and May to June in New Jersey.

LITERATURE CITED

Blatchley, W. S., and **C. W. Leng.** 1916. Rhynchophora or weevils of north eastern America. The Nature Publishing Company, Indianapolis. 682 pp.

Chittenden, F. H. 1895. The potato-bud weevil. Insect Life, 7: 350–352.

1897. The strawberry weevil (*Anthonomus signatus* Say). U.S. Div. Ent. Cir. 21. 7 pp.

Dietz, W. G. 1891. Revision of the genera and species of Anthonomini inhabiting North America. Trans. Amer. Ent. Soc. 18: 177–276.

Franklin, H. J. 1915. Report of cranberry substation for 1914. Mass. Agr. Exp. Sta. Bull. 160.

Frost, C. A. 1908. Notes on *Attelabus rhois* and parasite. Psyche. 15: 26–32.

Hardenberg, C. B. 1908. The cranberry insects of Wisconsin. Wis. Agr. Exp. Sta. Bull. 159: 201.

LeConte, J. L., and **G. H. Horn.** 1876. The Rhynchophora of America north of Mexico. Proc. Amer. Philos. Soc. 15 (96): 1–455.

Luggar, O. 1889. Beetles injurious to fruit producing plants. Minn. Agr. Exp. Sta. Bull. 66: 85–331.

Pierce, W. D. 1907. On the biologies of the Rhynchophora of North America. Studies from the Zool. Lab. Univ. of Neb. 4: 249–319.

1908. Studies of the parasites of the cotton boll weevil. U.S. Bur. Ent. Bull. 73: 63.

1916. Notes on the habits of weevils. Proc. Ent. Soc. Washington 18(1): 6–10.

Schwartz, E. A. 1884. Notes on the food habits of some North American Rhynchophora. Bull. Brooklyn Ent. Soc. 7: 84–85.

Ulke, H. 1902. A list of the beetles of the District of Columbia Proc. U.S. Nat. Mus. 25: 1–57.

Walsh, B. D. 1886. On the insects, coleopterous, hymenopterous and dipterous, inhabiting the galls of certain species of willow. II. Proc. Ent. Soc. Philadelphia 6: 265–270.

THE SUBGENUS POMPILINUS IN MEXICO (HYMENOPTERA, POMPILIDAE)[1]

HOWARD E. EVANS

Cornell University, Ithaca, N. Y.

The subgenus *Pompilinus* of the genus *Anoplius* is widely distributed throughout most of the globe, but appears to be best represented in the Nearctic region, where there are about twenty species and subspecies. The group is a difficult one, the differences between the species being slight and often rather subtle, while the amount of intraspecific variation is often not inconsiderable. I believe that future refinements in the systematics of the group will come from comparative etho-

[1]Accepted for publication February 10, 1955.

[2]This trip was made possible to the two participants by grants-in-aid from the Penrose Fund of the American Philosophical Society (Evans) and from the Associates in Tropical Biogeography of the University of California (Hurd).

logical studies. However, additional distributional data are also of value, and for this reason a review of the Mexican fauna of *Pompilinus* is presented at this time. Mexican records were omitted from the writer's recent revision of this group (Evans, 1951, pp. 277–325) for the simple reason that material from that country was then unavailable. The greater part of Mexico is a legitimate part of the Nearctic zoogeographical region, and in fact the Mexican highlands have played an important role in the distribution patterns of many North American Hymenoptera.

This report is based on 159 specimens representing 11 species. Most of these were collected by the present writer and Dr. Paul D. Hurd, Jr., of the University of California, on their expedition to Mexico during the summer of 1951.[2] This material is now at Cornell University and at the California Insect Survey, Berkeley (abbreviated CU and CIS, respectively, in the text). A number of specimens are also included from the American Museum of Natural History (AMNH), the United States National Museum (USNM), and the California Academy of Sciences (CAS).

Of the eleven species, ten are forms previously known from the United States, but rather surprising range extensions are indicated for some of these. The one new species is confined, so far as known, to sea beaches on the Pacific coast of the southern half of Mexico. The species are here considered in the same order as in the writer's revision of the group, with the new species inserted next to its closest relatives.

Anoplius (Pompilinus) grandiflexionis Evans

Described from the Big Bend region of Texas, this species has previously been known from only six females and one male, all from moderate altitudes in western Texas and New Mexico. It was of interest to find the species not uncommon at rather high altitudes (7000–8000 feet) in three localities in or near the Sierra Madre Occidental. The Durango localities were in open pine forest and the Zacatecas locality a scrubby shallow canyon in a high grassland. The male genitalia and subgenital plate agree well with those of the type; however, all the males are rather small (6–10 mm.) and none of them exhibit the pale stripe on the pronotum present in the type, nor do any of them have any evidence of hair-brushes on the fourth and fifth sternites.

DURANGO: 1 ♀, 5 mi. E. of Coyotes, 4 Aug., 1951 (Evans) [CU]; 5 ♂♂, El Salto, 3 Aug., 1951 (Evans & Hurd) [CU, CIS]; ZACATECAS: 9 ♂♂, 15 km. E. of Sombrerete, 28–31 July, 1951 (Evans & Hurd) [CU, CIS].

Anoplius (Pompilinus) subcylindricus (Banks)

This species is distributed in the United States and Canada from Quebec, North Dakota, and Utah south to Florida, Texas, and New Mexico. In the Nearctic parts of Mexico it is widely distributed and not uncommon, occurring at moderately high altitudes at least as far south as Michoacan and Puebla. The majority of Mexican specimens have the brush of hairs on the fourth abdominal sternite of the male somewhat longer than is usual in specimens from the United States, but this difference is by no means absolute. The genitalia and subgenital plate exhibit a considerable amount of variation as is usual in this species, but in general they agree well with U. S. specimens. The series of females from Zitacuaro, Michoacan, has the pubsecence of the body and legs unusually bluish and the wings strongly violaceous.

CHIHUAHUA: 1 ♀, 18 mi. W. of Jimenez, on *Baccharis*, 10 Aug. 1951 (Evans) [CU]; 1♂, San José Babicora, 5 July 1947 (M. Cazier) [AMNH]; DURANGO: 4 ♀♀, 8 mi. S. of Canutillo, 9 Aug. 1951, on *Guardiola tulocarpa* (Evans & Hurd) [CU, CIS]; 1 ♀, 1 ♂, Nombre de Dios, 1–5 Aug. 1951 (Evans) [HEE]; ZACATECAS: 6 ♀♀, 16 ♂♂, 15 km. E. of Sombrerete, 7300 ft., 28–31 July 1951 (Evans & Hurd) [CU, CIS]; JALISCO: 2 ♀♀, 2 ♂♂, Villa Guadalupe, 26 July 1951 (Evans & Hurd) [CU, CIS]; MICHOACAN: 4 ♀♀, 10 km. W. of Zitacuaro, about 8000 feet, on *Guardiola mexicana*, 11 July 1951 (Evans & Hurd) [CU, CIS]; PUEBLA: 1 ♀, 20 mi. W. of Puebla, 29 Dec. 1940 (G. Bohart) [CIS]; 12 ♂♂, 14 mi. W. of Huauchinango, about 7000 feet, 17 June 1951 (Evans & Hurd) [CU, CIS].

Anoplius (Pompilinus) texanus (Dreisbach)

This apparently uncommon species has been known from several localities in eastern Texas and one in Louisiana. A single pair taken deep in Mexico suggest that the species will be found to be widely distributed in the eastern part of the country. The female of this species has not been previously recognized, and there is no way of being certain that this female truly belongs here. It would run to *percitus* Evans in my keys (Evans, 1951, p. 280), but appears to differ in having the vertex slightly less strongly arched above the tops of the eyes.

MORELOS: 1 ♀, 1 ♂, Alpuyeca, about 4000 feet, 27 June- 3 July 1951 (Evans & Hurd) [CU, CIS].

Anoplius (Pompilinus) cylindricus (Cresson)

This species, which is widely distributed in eastern and central North America, is a highly variable one, with an apparent tendency to form local populations in various parts of its range. The single Mexican specimen resembles very closely a series taken by the writer at Fort Davis, in western Texas.

CHIHUAHUA: 1 ♂, Santa Clara, 2 July 1947 (W. Gertsch) [AMNH].

Anoplius (Pompilinus) californiae Evans

This very distinctive species ranges from central California and New Mexico south at least to Sonora and Baja California.

SONORA: 3 ♀♀, between Sonoyta and Punto Penasco, 500 feet, 25 Mch. 1949 (G. Bradt) [AMNH]; BAJA CALIFORNIA: 1 ♀, Angeles Bay, 7 May 1921 (E. VanDuzee) [USNM]; 1 ♀, 2 ♂♂, La Paz, 3–5 June 1921 (E. VanDuzee) [CAS]; 1 ♀, Magdalena Bay, 30 May [CAS]; 1 ♀, Cabo San Lucas, 16 Mch. 1953 (P. Arnaud) [CAS].

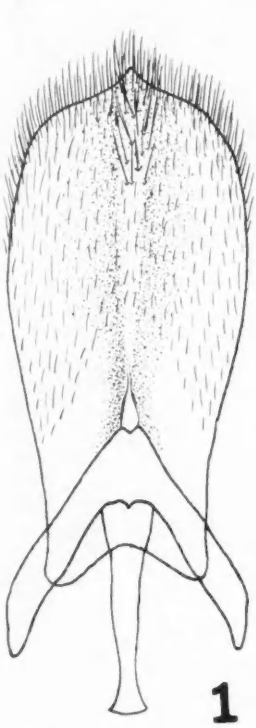
Anoplius (Pompilinus) litoreus new species

This species is related to *californiae*, the females having a strong tarsal comb as in that species and the males having genitalia of basically similar pattern. However, it is a smaller and much more silvery-pubescent species than *californiae;* the females have much shorter antennae and the males show constant differences in the shape of the aedoeagus and volsellae of the genitalia. The type series was collected at two localities on the Pacific coast, in both cases on the sand and vegetation of the sea beach, not far above the high water mark.

Female. Length 7.5 mm.; fore wing 6 mm. Black; wings lightly infuscated, with a darker outer marginal band; pubescence brownish-gray, conspicuously silvery on the lower front and temples, clypeus, base of mandibles, and to some extent on the coxae, the lower mesopleura, and the sides of the scutellum and metanotum. Clypeus, front, vertex, and front coxae with a few dark erect hairs; pronotum with a few short hairs; propodeum with only some very small, inconspicuous hairs on the sides.

Head distinctly broader than high, the vertex straight across between the tops of the eyes. Clypeus three times as broad as high, its apical margin slightly concave. Front of moderate breadth, the middle interocular distance 0.58 times the transfacial distance; inner orbits nearly parallel, the upper interocular distance 0.9 the lower. Ocelli in a rather flat triangle, the front angle slightly exceeding a right angle; postocellar line greater than ocello-ocular line as 7:6. First four antennal segments in a ratio of 15: 4: 14: 13, segment three equal to 0.6 the upper interocular distance.

Posterior pronotal margin broadly angulate. Propodeum convex, the declivity fairly well defined. Front tarsus with a strong comb, the



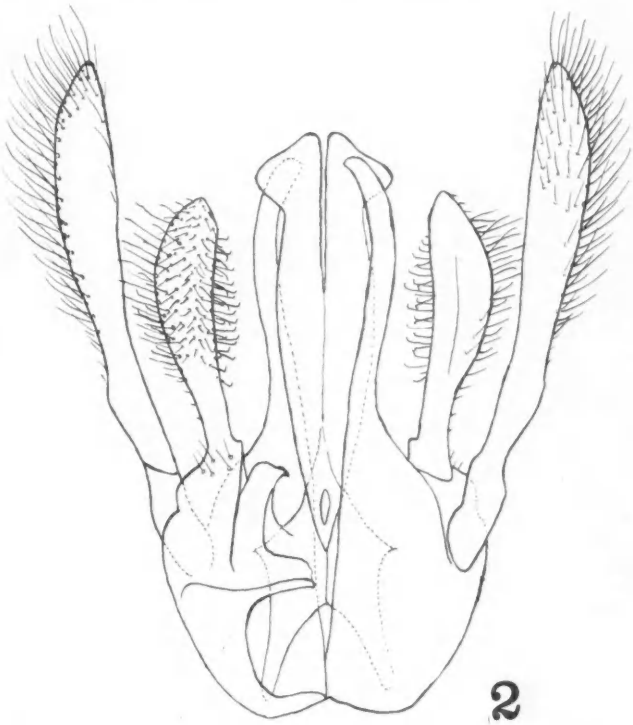


FIG. 1. Subgenital plate of *Anoplius (Pompilinus) litoreus* n. sp., ventral aspect. FIG. 2. Male genitalia of *Anoplius (Pompilinus) litoreus* n. sp., ventral aspect on left side, dorsal on right.

basitarsus with four comb-spines, the basal one about as long as the width of the tarsus, the other three nearly twice that long, the apical spine three-fourths the length of the second tarsal segment. Venation of the usual type in the subgenus, the third submarginal cell petiolate.

Twenty-one topotypic paratypes vary in size from 5.5 to 9.5 mm. and show some variation in the amount of silvery pubescence on the thorax; in some specimens the propodeum is quite silvery. The middle interocular distance varies from 0.55 to 0.62 times the transfacial distance (average 0.58); the third antennal segment varies from 0.46 to 0.63 times the upper interocular distance. In a few specimens the erect hair on the propodeum is longer and more prominent than in the allotype, while in others it is scarcely evident at all.

Twelve female paratypes from Acapulco vary in size from 5.5 to 8.5 mm. Although they agree closely in structure with the series from the type locality (San Blas), in every one the hair on the propodeum is quite prominent, and in some the mesopleura and middle and hind coxae and even the femora are clothed with erect hair. In this series the front averages somewhat broader, the middle interocular distance varying from 0.6 to 0.63 times the transfacial distance (average 0.61). The third antennal segment is not measurably longer than the fourth and is equal to from 0.45 to 0.5 times the upper interocular distance.

Male. Length 7 mm.; fore wing 5.5 mm. Black; wings very lightly infuscated, the fore wings with a broad outer marginal darker band. Pubescence silvery over the greater part of the head and thorax, including the coxae, also silvery on the propodeum and basal abdominal tergite, elsewhere brownish. Body without erect hairs except for a few on the front, vertex, pronotum, and subgenital plate.

Clypeus slightly over twice as broad as high, its apical margin truncate. Middle interocular distance 0.59 times the transfacial; upper and lower interocular distances subequal. Ocellar triangle shaped as in female, the postocellar line slightly greater than the ocello-ocular. First four antennal segments in a ratio of 6: 2: 5: 5, segment three 2.2 times as long as thick. Posterior pronotal margin broadly, feebly angulate. Median line of propodeum lightly impressed. Longer spur of hind tibia three fourths the length of the basitarsus.

Abdomen slender and elongate. Sixth sternite with a narrowly U-shaped apical emargination. Subgenital plate (fig. 1) with some rather prominent suberect setae toward the apex ventrally, and the apex fringed with hairs; median line feebly elevated, apically produced into a point. Genitalia (fig. 2) with the parameres curved but slightly, prominently setose on their outer margin; volsellae with only some very small setae at the base of the digiti; digiti subfusiform, slender toward the base; aedoeagus with a prominent, somewhat triangular apical expansion.

Twenty-six male paratypes, all from the type locality, agree very closely with the type. They vary in size from 4.5 to 8 mm.

HOLOTYPE: ♂, San Blas, Nayarit, 20 July 1951 (Evans; collected on bushy vegetation on the sea beach, apparently attracted to honeydew) [USNM]; ALLOTYPE: ♀, same data as type [USNM]. PARATYPES: 21 ♀♀, 26 ♂♂, same data as type (Evans & Hurd); 12 ♀♀, Acapulco, Guerrero, 1 July 1951, collected on sea beach near airport (Evans & Hurd) [Paratypes in CU, CIS, CAS, AMNH, USNM, and MCZ].

Anoplius (Pompilinus) estellina (Banks)

This uncommon and poorly known species has an exceedingly wide range, occurring from Idaho and Alberta south to Guatemala. The male subgenital plate and genitalia show a considerable amount of intraspecific variation, those figured by the present writer (Evans, 1951, plates 14 and 19) being somewhat atypical. The abrupt, narrow apical expansion on the aedoeagus and the very broad subgenital plate will, however, readily identify the species. *Pompilinus utahensis* and *P. minutus*, recently described by Dreisbach (1952, pp. 145, 147) from Utah and from Mexico, respectively, certainly belong to this species (New synonymy).

PUEBLO: 1 ♀, 2 ♂♂, 14 mi. W. of Huauchinango, about 7000 feet, on ground in clearing in forest, 17 June 1951 (Hurd) [CIS]; MICHOACAN: 1 ♂, Tancitaro, 6600 feet, 2–5 July 1940 [recorded by Dreisbach, 1952, p. 148]; OAXACA: 1 ♂, Oaxaca, 5000 feet, 20 July 1937 [recorded by Dreisbach]; GUATEMALA: 1 ♂, Cristobal, Tonicopan, 16 Aug. 1952 (R. H. Painter) [CU].

Anoplius (Pompilinus) insolens (Banks)

This species, which occurs transcontinentally in the United States in the Upper and Lower Austral Zones, is apparently widely distributed on the Mexican central plateau. The only known Mexican male, from Michoacan, has the subgenital plate somewhat more slender and hirsute than is usual in this species, but the genitalia agree closely with U. S. specimens.

CHIHUAHUA: 2 ♀♀, Santa Clara, 2 July 1947 (W. Gertsch) [AMNH]; 1 ♀, 16 mi. SE of Chihuahua, 11 July [AMNH]; SONORA: 1 ♀, Guaymas, 10 Apr. (L. O. Howard) [USNM]; DURANGO: 1 ♀, 8 mi. S. of Canutillo, 9 Aug. 1951, on *Guardiola tulocarpa* (Evans) [CU]; ZACATECAS: 1 ♀, 15 km. E. of Sombrerete, about 7300 feet, 28–31 July 1951 (Hurd) [CIS]; MICHOACAN: 1 ♀, 1 ♂, 10 km. W. of Zitacuaro, about 8000 feet, 11 July 1951 (Evans) [CU].

Anoplius (Pompilinus) clystera (Banks)

There are but three Mexican records for this

species, which is widely distributed in the southwestern United States.

CHIHUAHUA: 1 ♀, 18 mi. W. of Jimenez, on *Baccharis*, 10 Aug. 1951 (Evans) [CU]; JALISCO: 2 ♀ ♀, Guadalajara, 23–24 July 1951 (Evans & Hurd) [CU, CIS].

Anoplius (Pompilinus) splendens (Dreisbach)

This is a characteristic species of the Upper and Lower Austral Zones of eastern United States, ranging as far west as Utah and Arizona. It is not surprising to discover that its range extends into north Mexico.

CHIHUAHUA: 1 ♀, Carta Blanca, 16 mi. W. of Matachic, 8 July 1947 (W. Gertsch) [AMNH]; DURANGO: 1 ♀, 8 mi. S. of Canutillo, 9 Aug. 1951 (Hurd) [CIS].

Anoplius (Pompilinus) fraternus (Banks)

This Atlantic and Gulf coastal species occurs in Mexico at least in the northeast corner.

TAMAULIPAS: 1 ♂, La Pesca, 17 May 1952 (Cazier, Gertsch, Schrammel) [AMNH].

REFERENCES CITED

Dreisbach, R. R. 1952. Additional new species in the genera *Anopompilinus*, *Anoplius*, *Pompilinus*, and *Pycnopompilus* (Hymenoptera: Psammocharidae) and corrections of previous papers. Amer. Midl. Nat. 48: 145–60.

Evans, H. E. 1951. A taxonomic study of the nearctic spider wasps belonging to the tribe Pompilini (Hymenoptera: Pompilidae). Part II: Genus *Anoplius* Dufour. Trans. Amer. Ent. Soc. 76: 207–362.

SELECTIVE RESPONSES OF WILD DROSOPHILIDAE TO NATURAL AND ARTIFICIAL ATTRAHENTS[1]

C. K. DORSEY[2] AND H. L. CARSON[3]

For the purpose of investigating the effectiveness of several natural (naturally occurring fungi) and artificial (ingredients formulated in the laboratory) baits in attracting forest inhabiting species of insects, a series of continuous trapping trials were initiated at the beginning of the summer of 1952 and were conducted without interruption until the end of the summer of 1954. Each trapping year was divided into two seasons, summer (April through October), and winter (November through March). The present paper is concerned with flies of the family Drosophilidae, principally of the genus *Drosophila*, which came to the traps.

MATERIALS AND PROCEDURE

The collection sites were located along the top of a mountain ridge, more than a mile from any human habitation, in a densely forested area in Coopers Rock State Forest, West Virginia. Seven trees selected as trapping sites were located approximately 150 feet apart. Each tree was provided with a wire bait holder (rack) accommodating eight baits. This rack was nailed to the tree at a point about six feet above the forest floor. The racks were bent to conform to the contour of the tree trunk in a horizontal plane. The individual bait containers were 50-ml. beakers. Each was provided with a waxed, conical, paper roof secured by a rubberband and adjusted so that rain was excluded and so that insects were prevented from falling, by chance, into the bait. The bait containers were spaced approximately four inches apart in the rack around the tree trunk and each bait was in direct competition with the others.

The fourteen different baits used in these trials are identified in Table I, which also indicates the attractiveness of the various baits for these flies. All baits were in liquid form. The fungus baits were grown in liquid glucose-urea media[4] and the other baits were mixed with water. One control beaker containing water was included with each series (rack) of competing baits.

The trapping sites were visited at weekly intervals for maintenance purposes. The trapped insects were removed and fresh baits were provided for each rack. At each maintenance visit, the position of each bait was changed in the rack in a random manner. All insects collected were preserved in alcohol and subsequently sorted to at least order and family rank. The dipterous family Drosophilidae was particularly well represented and these specimens were sexed and identified where possible to genus and species from each bait. Five genera and 26 species of

[1]Published with the approval of West Virginia Agricultural Experiment Station as Scientific Paper No. 502. Accepted for publication March 29, 1955.

[2]Professor of Entomology, West Virginia University, Morgantown.

[3]Associate Professor of Zoology, Washington University, St. Louis, Missouri.

[4]For *E. fagacearum:* Glucose 50 gm., Urea 1. gm., $MgSO_4 \cdot 7H_2O$ 0.5 gm., KH_2PO_4 1 gm., $Fe^{+++} + Zn^{++}$ 0.2 mg., Mn^{++} 0.1 mg., biotin 5 mg., thiamine 100 mg., distilled water 1 liter, pH 5.5.

For other fungi: same formula except the following ingredients were also added: Pyridoxine 100 mg/L and inositol 5 mg/L.

TABLE I

BAITS USED AND THE NUMBER OF WEEKLY BAIT EXPOSURES APRIL, 1952 THROUGH AUGUST, 1954

BAIT	TOTAL NUMBER		AVERAGE NUMBER OF *Drosophila* PER 7-DAY EXPOSURE
	Drosophilidae Collected	7-day Exposures of the Bait	
#1 Water	6	90	0.07
#2 Ethyl alcohol (4%)	9	20	0.5
#3 Ethyl acetate (50%)	20	6	3.3
#4 Yeast-water	33	6	5.5
#5 Vinegar[a]) —molasses[b]) —water (33⅓%)	8,306	86	96.6
#6 Molasses[b]) —water (50% each)	2,553	55	46.4
#7 Vinegar-water (50% each)	1,573	60	26.2
#8 Apple pomace-water	224	7	31.9
#709 *Endoconidiophora adiposa* (Butler)	5	8	0.6
#710 *E. fimbriata* (Ellis & Halls) David	2	7	0.3
#711 *E. virescens* David	9	8	1.1
#2065 *E. fagacearum* Bretz ("oakwilt")	769	78	9.9
#717 *Ophiostoma pluriannulata* (Hedg.)	859	90	9.5
#718 *Graphium rigidum* (Pers.) Sacc.	713	68	10.5
Total	15,081		

a) Apple Cider Vinegar.
b) Black Strap Molasses.

Drosophilidae were collected by this type of trapping in the forest. Sturtevant (1921) lists three genera and four species as occurring in West Virginia. A more recent work on the genus (Patterson, 1943) does not include collections from this state.

RESULTS

Table II identifies the species and shows the total number of each which was collected. Records of *Drosophila nebulosa* Sturt. in the United States are few. It has been regularly found in Texas, but had not previously been collected north of the 32nd parallel (Patterson and Wagner, 1943); a single specimen is known from Florida (Patterson, 1943) and two specimens were collected from northwestern Nebraska (Williams and Miller, 1952). The species has been considered characteristic of the arid tropics of Central America and Brazil (Pavan, 1952). Its occurrence in natural habitats in West Virginia and Nebraska demonstrates a more extensive distribution.

Although females of the *D. affinis* group could not be distinguished in alcoholic specimens, the males were identified to species. In a total of 3577 males, 74.4% were *affinis*, 15.6% *athabasca*, and 10.0% *algonquin*. *D. naragansett* was not distinguished from *athabasca*.

Since the description of the type specimen from Kushla, Alabama (Sturtevant, 1921), the only other published report of *D. alabamensis* is that of Carson and Stalker (1951) from eastern Missouri. The 16 specimens of this species collected in West Virginia therefore represent an unusual find.

During the initial period of the bait tests in the summer of 1952, the different baits were tested in competition with one another to determine the relative general effectiveness of each. Throughout the winter of 1952–53 only baits nos. 717, 5 and 1 were used. Beginning with the summer period of 1953 and continuing through the winter of 1953–54 and the summer of 1954, baits nos. 1, 5, 6, 7, 717, 718 and 2065 were the only ones tested.

In making comparative studies of the effectiveness of the different baits only the collection data from the trapping completed during 55 seven-day bait exposures were used. Those data obtained from the trapping records of 20 species of *Drosophila* were analyzed statistically by the analysis of variance square root transformation method. Table III presents the results of this analysis and the comparison of the effectiveness of artificial and fungus baits in attracting Drosophilidae.

As shown in Table III, the artificial baits are

TABLE II

DROSOPHILIDAE COLLECTED AT COOPERS ROCK STATE FOREST, WEST VIRGINIA, 1952–54

SPECIES (males and females)	SUMMERS 1953 and 1954	SUMMER 1953 AND WINTERS 1952–53 AND 1953–54	TOTALS
Drosophila affinis group[a]	8,330	2,343	10,673
alabamensis Sturt.	9	7	16
buscki Coq.	10	3	13
colorata Walk.	144	44	188
duncani Sturt.	136	64	200
funebris Fab.	0	1	1
hydei Sturt.	6	3	9
immigrans Sturt.	62	62	124
macrospina Stalk. & Spen.	85	6	91
melanica group[b]	460	50	510
melanogaster Meig.[c]	64	44	108
nebulosa Sturt.	4	4	8
putrida Sturt.	987	333	1,320
robusta Sturt.	588	356	944
sigmoides Loew.	1	1	2
testacea Van Rosen	4	2	6
transversa Fall.	85	27	112
Aulacigaster leucopeza Meig.	406	261	667
Leucophenga varia Walk.	9	1	10
Chymomyza amoena Loew [d]	52	25	77
Mycodrosophila dimidiata Loew.	1	1	2
Total	11,443	3,638	15,081

[a]) includes *D. affinis* Sturt., *athabasca* Sturt. & Dobz. and *algonquin* Sturt.
[b]) includes *D. melanica* Sturt. and a small number of *nigromelanica* Patt. & Wh.
[c]) no specimens of *D. simulans* were collected.
[d]) includes a small number of *Chymomyza procneimoides* Wheeler.

significantly more effective than the fungus baits in attracting most of the species of *Drosophila* encountered in this study. In fact, in no case does any species show a significant preference for fungus baits under the conditions of these experiments. Nevertheless, the degree of preference varies from species to species. In order to express these relative preferences, the six baits which attracted the most flies (nos. 5, 6, 7, 717, 718, 2065, Table I) were selected for further analysis. The number of trapped flies of each of the ten most abundant species was determined for each of the six baits. In the case of all baits, except number 6, the numbers of flies were reduced by computation to those which would be expected on the basis of the minimum number (55) of 7-day exposures. These numbers were then converted to percentages of the adjusted total for each species, Table IV. This table also shows the mean percentage of all ten species collected for each bait.

By inspecting the distribution of flies it is seen that the variance in preference by the different species for artificial baits is pronounced. *D. melanogaster* and *immigrans*, for example, exhibit the strongest preference for the artificial baits, especially bait no. 5. These preferences are much stronger, for instance, than those manifested by *marcospina* and *colorata*. Figure 1 presents these facts for each species in terms of its percentage of deviation from the mean of all ten species on either artificial or fungus baits.

DISCUSSION

The *D. affinis* group were the most numerous of all species collected, comprising 70.8% of the total. The next most numerous species were *D. putrida* (8.7%), *robusta* (6.3%) and the *melanica* group (3.4%). *Aulacigaster leucopeza* constituted 4.4% of the total catch. The other species comprise the remaining 6.4%.

The arbitrary division of the year into two trapping seasons (summer and winter) was selected for the convenience of considering all of the specimens from the several orders collected. It is realized that for seasonal distribution studies pertaining to Drosophilidae alone, more careful consideration of other seasons would be necessary.

A study of the data to compare the effectiveness of artificial and fungus baits shows (Table III) that at least eight species (*D. affinis* group, *melanica* group, *robusta*, *immigrans*, *duncani*, *melanogaster*, *putrida* and *macrospina*) prefer the artificial type of bait. In considering the mean

TABLE III

COMPARATIVE EFFECTIVENESS OF ARTIFICIAL AND FUNGUS BAITS IN ATTRACTING DROSOPHILIDAE

SPECIES	BAITS	MEAN NUMBER OF SPECIMENS COLLECTED[a]		F VALUE FOR COMPARISON OF MEANS
	ARTIFICIAL VS FUNGUS	ARTIFICIAL BAITS	FUNGUS BAITS	
Drosophila immigrans	A/F 5% level	186.59	9.00	6.04*
duncani	A/F 5%	339.66	82.81	7.71*
affinis group	A/F 1%	20,620.96	3,158.44	12.80**
melanica group	A/F 1%	1,842.92	377.52	26.65**
robusta	A/F 1%	2,289.62	514.38	14.14**
putrida	A/F 1%	3,047.04	1,177.86	12.40**
melanogaster	A/F 5%	156.25	5.80	6.14*
macrospina	A/F 1%	257.60	179.82	11.03**
colorata	NS.	238.08	299.98	NS.
busckii	NS.	16.40	1.00	NS.
hydei	NS.	14.59	2.99	NS.
testacea	NS.	7.45	2.99	NS.
transversa	NS.	311.87	88.54	NS.

** = Significant at 1% level.
* = Significant at 5% level.
NS. = Not significant (These species exhibited no specific preference for the baits)
[a] All data transposed to square root transformation. These figures are pooled mean catches of the three artificial and the three fungus baits used in these studies.

TABLE IV

OCCURRENCE OF TEN SPECIES OF *Drosophila* ON SIX DIFFERENT ARTIFICIAL AND FUNGUS BAITS

SPECIES	PERCENT ON ARTIFICIAL BAIT			PERCENT ON FUNGUS BAIT			ADJUSTED TOTAL
	#5 (v-m-w)	#6 (m-w)	#7 (v-w)	#717	#718	#2065	
affinis group	57.9	18.9	12.5	3.3	3.4	4.0	7,497.8
melanica group	38.4	29.8	16.0	4.5	4.9	6.3	378.8
robusta	48.5	22.2	13.5	4.2	5.1	6.4	549.7
putrida	39.7	30.0	9.8	6.1	8.8	5.6	941.5
melanogaster	66.3	17.8	9.5	0.8	2.4	3.1	67.5
immigrans	62.2	20.8	10.1	0.8	1.1	4.9	72.0
colorata	55.4	2.3	8.6	10.0	7.6	16.0	127.9
duncani	36.6	31.0	7.1	6.4	9.8	9.0	141.5
macrospina	31.4	21.4	11.1	13.1	8.7	14.1	65.3
transversa	48.2	16.4	17.4	6.2	9.2	2.6	79.4
mean % for 10 species	48.5	21.1	11.6	5.5	6.1	7.2	

[a]The raw data were placed on an equal basis by adjusting the number of each species to that expected on the basis of 55, 7-day exposures (see Table I and text). m = molasses, w = water, v = vinegar.

number of specimens collected (pooled mean catches), only one species, *colorata*, evinced signs of preferring fungus to artificial baits. This trend, however, is not statistically significant. The remainder of the species are too scarce in the collections to warrant any conclusions as to preference.

The data presented in Table IV and figure 1 show the manner in which the preferences of the different species vary; thus, *D. colorata* and *macrospina* accept fungus baits more readily than the other species, whereas *melanogaster* and *immigrans* show the reverse tendency and they are found almost exclusively on the artificial baits. These results are in direct agreement with those of daCunha, Dobzhansky and Sokoloff (1951) who tested the food preferences of various

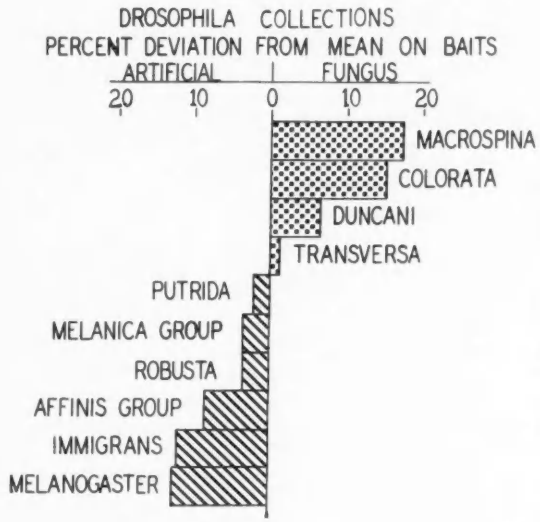


FIG. 1—Relative preference of ten species of *Drosophila* for artificial (left) and fungus baits (right).

species of *Drosophila* near Mather, California in the Sierra Nevada region. These authors used eight different species of yeasts grown in pure culture on liquid media; as a control, banana mash fermented with Fleischmann's yeast was used. This latter bait, like the vinegar-molasses-water combination (no. 5) used in the present work, attracted by far the most flies. Nevertheless, the different species vary in the readiness with which they will visit certain yeasts.

Bait no. 5, (vinegar-molasses-water) is the most effective of the baits used by us when both the total number of specimens (Table I) and species (Table IV) are compared. Obviously, the addition of molasses to the artificial baits greatly improved their attractiveness. The general attractive properties of the oak wilt fungus *Endoconidiophora fagacearum*, *Ophiostoma pluriannulata* and *Graphium rigidum* are about equal (Tables I and IV); these three fungi commonly occur in close association in natural habitats.

ACKNOWLEDGMENT

The work of the junior author is supported by grant NSF-G421 of the National Science Foundation.

SUMMARY

1. Regular collections of Drosophilidae in the forest for a continuous period of three summers and two winters in Coopers Rock State Forest, West Virginia, have been made with the use of artificial and fungus attrahents.

2. Approximately 15,000 specimens belonging to 5 genera and 26 species of Drosophilidae were collected.

3. An artificial bait consisting of equal parts vinegar, molasses and water was the most effective and attracted flies at the average rate of about 100 per week. This is almost twice as effective as molasses and water alone and about ten times as effective as culture filtrates of *Ophiostoma pluriannulata*.

4. The species of *Drosophila* attracted to the fungus and artificial baits used in these trials, with the exception of *colorata*, were most numerous in the artificial baits. The strength of positive bait preferences varies from species to species. *D. colorata* and *macrospina* show a tendency to accept fungus baits more readily than other species; likewise *D. melanogaster* and *immigrans* exhibit a similar tendency to accept artificial baits.

REFERENCES

Carson, H. L., and **H. D. Stalker.** 1951. Natural breeding sites for some wild species of *Drosophila* in the eastern United States. Ecology 32: 317-30.

da Cunha, A. B., Th. Dobzhansky and **A. Sokoloff.** 1951. On food preferences of sympatric species of *Drosophila*. Evolution 5: 97–101.

Patterson, J. T. 1943. Studies on the genetics of *Drosophila*. III. The Drosophilidae of the Southwest. Univ. Texas Publ., 4313: 7–327.

Patterson, J. T., and **R. P. Wagner.** 1943. Geographical distribution of species of the genus *Drosophila* in the United States and Mexico. Univ. Texas. Publ. 4313: 217–281.

Pavan, C. 1952. Relacões entre populacões naturais de *Drosophila* e o meio ambiete. Thesis: University of São Paulo, Brazil. 1–107.

Sturtevant, A. H. 1921. The North American Species of *Drosophila*. Carnegie Inst. Washington Pub. no. 341: 1–150.

Williams, D. D., and **D. D. Miller.** 1952. A report on the *Drosophila* collections in Nebraska. Bull. Univ. Nebr. State Mus. 3: 1–19.

NEW NORTH AMERICAN SARCOPHAGIDAE, WITH SOME NEW SYNONYMY (DIPTERA)[1]

HAROLD R. DODGE
Forest Insect Laboratory, Missoula, Montana

The following notes and descriptions clarify certain names currently used by the writer in identifications, and describe a few unusual new species. The types of the new species are deposited in the U. S. National Museum, Washington, D. C. The writer takes pleasure in dedicating two new genera to the mountains of their capture. Figure 7 was drawn by Chester J. Stojanovich; the remainder by the author.

Kennesawmyia new genus

Closely allied to *Brachicoma* Rondani, but easily separated by the truncate wings and the abruptly sunken clypeus. It traces to *Laccoprosopa* Townsend in Townsend's (1935) key to genera of *Agriini*. Genotype: *K. truncatipennis* new species, to which one is referred for a more complete description.

Kennesawmyia truncatipennis new species
(FIGS. 1-6)

Length 6 mm., a small, dark species unique by the truncature of the wing apices.

Male: Head with front at narrowest 0.23 of head width; frontal rows of about eight bristles; frontal stripe parallel sided; fronto-orbital bristles lacking; outer vertical slightly developed, half as long as the inner; antenna (fig. 2) black, arista very finely pubescent, second segment longer than wide, third segment swollen on basal two-fifths; clypeus deeply and abruptly excavated; epistoma slightly below vibrissae, strongly produced, parafacialia less than half as wide as clypeus, with row of rather strong bristles; palpi slender, black, perhaps longer than the haustellum; beard and occiput clad with black hairs.

Thoracic chaetotaxy: acrostichals 0?: 1, dorocentrals 3: 3, intra-alars 1: 2, supra-alars 2: 3; scutellum with a small discal and 3 strong marginal bristles, of which the apical pair are large, divergent and close-set; notopleurals 2; sternopleurals 3, propleuron bare; infrasquamal setules present.

Wings (fig. 4) with costal spine vestigial, vein 1 bare, vein 3 with about seven setules extending more than half way to the cross vein. Wing apex truncate, the truncature involving the apical cell and half of the preceding one.

Legs with hind coxa bare behind; mid femur with comb of four small spines. Hind legs lost.

Abdomen with median marginals on third segment, spiracles 1 to 5 situated near ventral margins of tergites; sternites clad with dark hairs and without bristles; sternite 5 not emarginate apically.

Genitalia (fig. 1-5): genital segments black, the first with two rows of bristles, the second segment cleft mid-dorsally to its base. Forceps moderately separated and parallel on apical half; in lateral view slender, curved to a sharp point. Accessory plate only slightly shorter, finger-shaped, slightly removed from the forceps, fused to the second genital segment; in posterior view slightly curved and tapering apically, and with an external angulation near its base. Penis and attached structures dissected and drawn in three views (fig. 1, A-C). Penis a single segment, parallel-sided in posterior view but in lateral view greatly narrowed at middle by an anterior excavation. Anterior claspers nearly as long as the penis and fused anteriorly to enclose it on three sides. Posterior clasper long, slender, curved, swollen basally. Sperm pump sclerite of small size, subtriangular in shape. Spiracle 7 lateral, on the first genital segment; the sixth in the membrane, almost directly below.

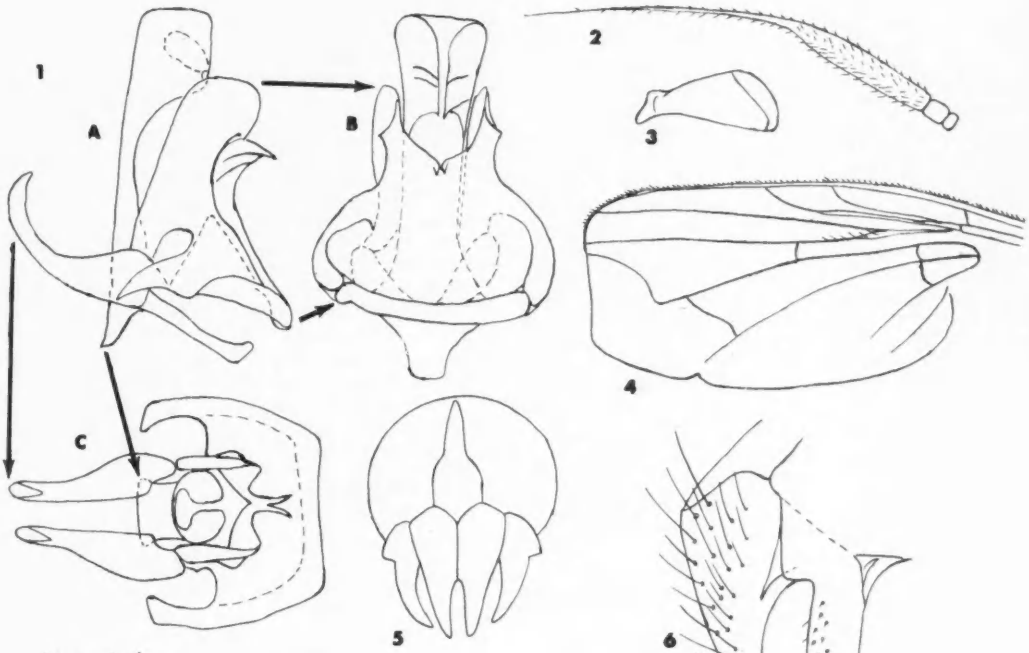
The single specimen is not in good condition. The wings are hyaline and squamae white. Body color black; pollinosity probably as in *Brachicoma* but obscured by greasiness.

Holotype male: Kennesaw Mountain, Cobb County, Georgia, April 17, 1953, H. R. Dodge. Type number 62334, U. S. National Museum. The specimen was taken by net collecting at the summit of the mountain, at noon.

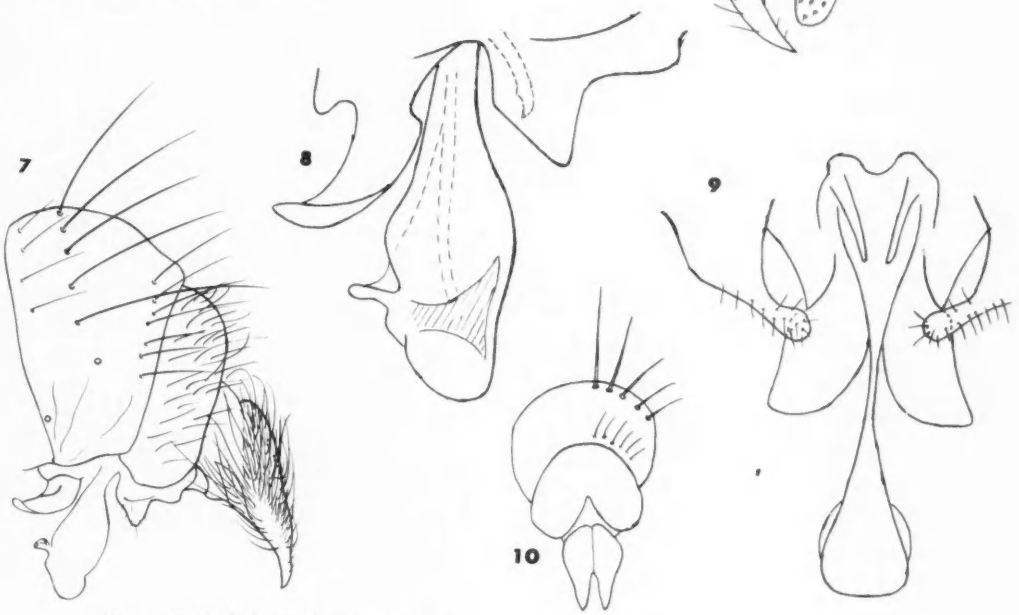
EXPLANATION OF PLATE I

FIGS. 1-6. *Kennesawmyia truncatipennis* new species.
FIG. 1. Male genitalia (penis and claspers) in three positions; A lateral view (from left side), B anterior view, C ventral view.
FIG. 2. Arista.
FIG. 3. Sperm pump sclerite.
FIG. 4. Wing.
FIG. 5. Forceps, accessory plate and second genital segment, posterior view.
FIG. 6. Forceps and accessory plate, lateral view.
FIGS. 7-10. *Rabunmyia compressa* new species.
FIG. 7. Genital composite, viewed from left side.
FIG. 8. Penis, claspers, and accessory plate, further enlarged.
FIG. 9. Penis, claspers and left accessory plate, posterior view.
FIG. 10. Genital composite, posterior view.

[1]From the Communicable Disease Center, Public Health Service, U. S. Department of Health, Education, and welfare, Savannah, Georgia. Accepted for publication April 1, 1955.



Figs. 1-6
Kennesawmyia truncatipennis



Figs. 7-10 Rabunmyia compressa

Rabunmyia new genus

The genus is allied to *Bombobrachycoma* Townsend, to which it traces in Townsend's key (1935, couplet 56, page 180), but differs by the separated anterior claspers and by the strongly compressed penis. It also resembles *Sarcofahrtia* Parker, but differs by having the arista pubescent and in details of the penis. Infrasquamal setules absent in the male only. Propleuron, prosternum, postalar declivity and metasternum bare; hind coxae bare behind. Third abdominal segment with a marginal row of bristles. Genital segments black, the first with two rows of bristles. Sternite 5 with hind margin not excavated. Head profile nearly as in *Bombobrachycoma;* vibrissal axis shorter than antennal axis, face receding; haustellum shorter than palpi; anterior metacephalic suture not evident. Male hind tibia non-villous; mid femur with a comb of seven short, blunt spines.

The strongly compressed penis, especially in the genotype, *R. compressa* new species, is a distinguishing feature of this genus. Two species are included in the genus.

KEY TO SPECIES

1. Sternopleurals three, or with several slightly differentiated bristles in the position of the middle bristle; vibrissae distinctly above the epistoma; third antennal segment yellowish only at base; penis strongly compressed; posterior clasper small, not enlarged distally ..... **compressa**
   Sternopleurals two; vibrissae situated at epistoma; third antennal segment entirely yellowish; penis moderately compressed; posterior clasper long, enlarged distally ..... **fattigi**

Rabunmyia compressa new species

(Figs. 7–10)

Length 9-9.5 mm. A grey-pollinose species with marked sexual dimorphism (see description of female); bristles of body and legs fine; thorax three-striped; abdomen grey pollinose, with three longitudinal stripes and only vaguely variegated. Genital segments black; penis strongly compressed in posterior view, thus suggesting its specific name.

Male: head greyish, shorter at vibrissal than at antennal axis, metacephalon not prominent in profile and with suture visible only on the occiput; occiput nearly flat, entirely black-haired; ocellars weak; outer vertical slightly differentiated; front at narrowest 0.17 of head width; fronto-orbitals absent; frontal rows of 11 to 12 bristles, divergent anteriorly and reaching base of second antennal segment; frontal stripe black, considerably broadened anteriorly; parafacial and parafrontal region with about three rows of fine hairs; antennae dark, segment 3 reddish at base, less than twice as long as segment 2; arista with segment 2 as long as wide, segment 3 pubescent on basal half, swollen on basal fifth; facial ridges with scattered bristles below; vibrissae slightly above the epistoma and slightly approximated; clypeus only slightly depressed and moderately warped forward to epistoma; the latter obtuse and somewhat narrowed. Palpi reddish, longer than haustellum; cheek nearly half the eye height.

Thoracic chaetotaxy: acrostichals 2: 1, the anterior small; dorsocentrals 3: 3; intra-alars 1: 2; supra-alars 2: 3; humerals 3; bristles of posterior callus 2; scutellum with 1 small discal and 3 evenly-set, strong marginals, of which the basal is preceded by a weaker one and the apical pair are strong, rather close-set, and with scattered setules between. Notopleuron with 2 bristles and 6 to 8 scattered setules; sternopleurals 2, with several weakly differentiated bristles in the position of the middle bristle.

Wing slightly infuscated; costal spine vestigial; vein 1 bare; vein 3 with 3 to 5 setules at its base. Squama slightly infuscated. Epaulet brown.

Legs: hind tibia non-villous, middle femur with comb of 7 spines.

Abdomen with median marginals (an interrupted marginal row) on third segment; spiracles 1 to 5 on tergites, near ventral margins.

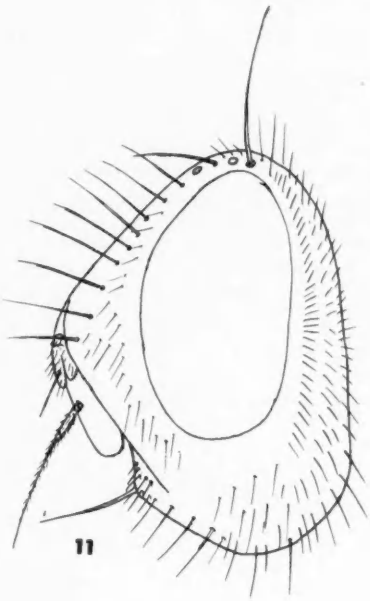
Genitalia (figs. 7–10): genital segments black, pollinose, the first segment with a median row of 10 strong bristles and a marginal row of 12 much smaller, the rows not interrupted mid-dorsally; spiracle 6 on lower part of segment, below spiracle 7. Second segment short, with scattered hairs, cleft only a short distance (fig. 10) by the perianal region. Forceps parallel and moderately separated for half their length, rather flattened, apices shining; accessory plate reddish, fused to ventral margin of second segment, with two prominences in lateral view, of which the anterior is acute, with apices incurved. Penis a single dark brown segment, strongly compressed at middle of length; claspers black, the anterior strongly flattened, not fused together, the posterior pair small, slender. Fifth sternite not emarginate posteriorly. Posterior to the fifth sternite and not attached to it, is a narrow, symmetrical sclerotized band.

Female: Front at narrowest 0.34 of head width; frontal stripes broad, the sides nearly

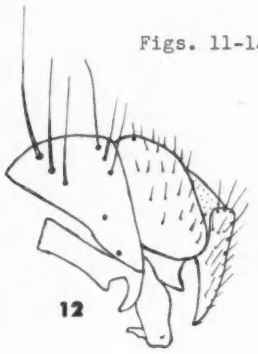
EXPLANATION OF PLATE II

Figs. 11–14. *Rabunmyia fattigi*, new species.
Fig. 11. Head of male, viewed from left.
Fig. 12. Genital composite, viewed from left.
Fig. 13. Penis, claspers and accessory plate, further enlarged.
Fig. 14. Penis, posterior view.
Figs. 15–20. *Chaetoravinia* Townsend, diagrams of female genital sternites, ventral views of sternites 6 to 8, of which the eighth is topmost.
Fig. 15. *Chaetoravinia anadra* new species.
Fig. 16. *Chaetoravinia derelicta* (Walker).
Fig. 17. *Chaetoravinia latisetosa* (Parker).
Fig. 18. *Chaetoravinia effrenata* (Walker).
Fig. 19. *Chaetoravinia errabunda* (Wulp).
Fig. 20. *Chaetoravinia laakei* (Hall).

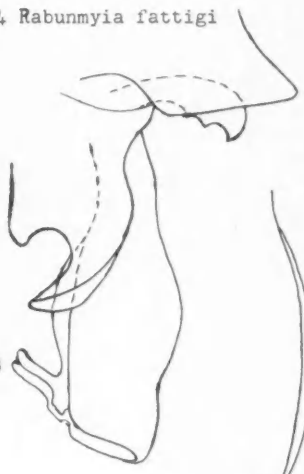
Figs. 11-14 Rabunmyia fattigi



11



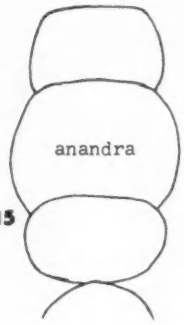
12



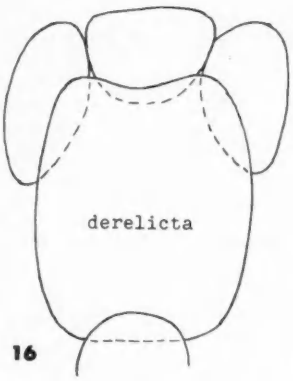
13

14

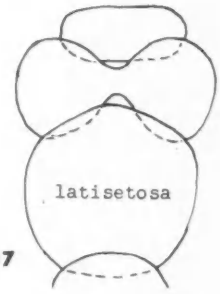
Figs. 15-20
female genital sternites
of Chaetoravinia



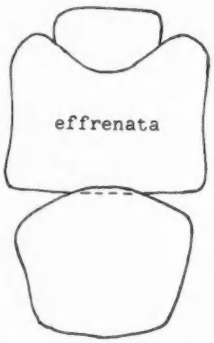
15



16

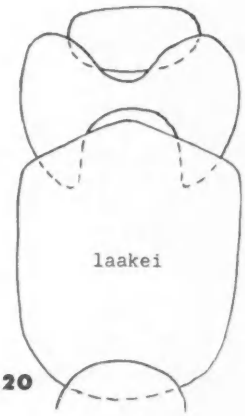


17



18

19



20

parallel; fronto-orbitals two pair proclinate and one pair divergent. Scutellar chaetotaxy identical to the male. Wing with short spur veins at the bend of vein 4 and on the posterior cross vein. Abdomen much more broadened and less distinctly three-striped than in the male; third tergite with a distinct median row of bristles. First genital tergite black, not divided dorsally, with setules and gray pollen and a rather strong marginal row of bristles; sternotheca apparently subequal in width to the preceding sternites, sternite 6 rather shining, short, with emarginate hind margin partly concealing the reddish sternite 8; other details of genitalia not apparent in the undissected specimen.

The female presents unusual sexual dimorphism in the following characters: infrasquamal setulae present; parafrontals with strong hairs, of which four or five appear as a partial second row of frontal bristles; frontal rows less divergent than in the male; bristles of head and body much stronger than in the male.

Holotype male and *allotype* female, Rabun Bald, Rabun County, Georgia, 4714 feet altitude, September 24, 1952, H. R. Dodge. Type number 62336, U. S. National Museum. The specimens were taken by general collecting at the summit, 11 a.m. to 1 p.m.

Rabunmyia fattigi new species

(FIGS. 11–14)

Length 7.5 mm. Similar to *compressa* except in size and as noted in the key.

Male: head (fig. 11) with front 0.18 of head width, fronto-orbitals absent; antennae with segment 3 entirely dull reddish; vibrissae at level of epistoma; squamae white; sternopleurals 2. Genitalia (figs. 12–14): genital structure similar to *compressa* except posterior clasper much longer and thickened apically and penis less compressed, differing in minor details in lateral view.

Female: Front 0.31 of head width, anterior acrostichal and frontal bristles stronger than in male, no distinct row of bristles outside the frontal row. Clypeus raised medianly so that it is evident in lateral view of head. Genital segments black (except sternite 7 reddish), the first genital tergite with posterior margin angled middorsally, not evenly arched as in *compressa*.

Both sexes have the trochanters reddish-brown, the legs otherwise black.

Holotype male, Atlanta, Georgia, April 26, 1939, at light, P. W. Fattig; *allotype* female, Atlanta, Georgia, May 20, 1949, P. W. Fattig. Type number 62335, U. S. National Museum.

Chaetoravinia Townsend

Chaetoravinia Townsend, 1917, Proc. Biol. Soc. Washington, 30: 193.
Sarcophaga Hall, 1928, Ann. Ent. Soc. Amer. 21: 331–352. Aldrich, 1930 Proc. U. S. Nat. Mus. 78(12)1–39. Hall, 1931, Ann. Ent. Soc. Amer. 24: 181–182.
Chaetoravinia Townsend, 1935, Manual of Myiology, pt. 2, 186–192. Townsend, 1938, Manual of Myiology, pt. 6, p. 17–18.
Sarcophaga Hallock, 1940, J. New York Ent. Soc. 48: 221–223.
Chaetoravinia Lopes, 1946, Mem. Inst. O. Cruz 44: 131–137.
Ravinia Roback, 1954, Ill. Biol. Monog., 23(3–4): 72–74.

Members of this genus are quite readily defined by having the first wing vein setulose and the epaulet yellow to brown, not black. It is a group of New World species, obviously related to *Ravinia* (R.-D.) but showing greater diversity in the structure of the genitalia of both sexes. With the discovery of a new species and a change in name, a key is presented to separate the United States species and the female genital sternites are illustrated.

KEY TO THE U.S. SPECIES OF CHAETORAVINIA

1. Males 2
   Females 8
2. Forceps distinctly bowed in posterior view, their apices convergent 3
   Forceps not distinctly bowed, their apices parallel 4
3. Anterior clasper straight, broadened and parallel-sided on basal half; sternite 5 with lobes narrow, broadly divergent (Widespread east of Rocky Mountains) ..... **derelicta**
   Anterior clasper curved on basal half; sternite 5 with lobes narrowly separated, their posterior apices broadened and truncate (Mexico and Calif. to Ga.) ..... **errabunda**
4. Forceps curved in lateral view; anterior clasper with apex broadened (Tex., Calif., C. A., W. I.) ..... **effrenata**
   Forceps straight in lateral view; anterior clasper with apex not broadened 5
5. Anterior clasper apically curved in sectional view, the apex thus appearing notched; fourth tergite dark 6
   Anterior clasper apically flattened in sectional view, the apex not notched; fourth tergite commonly yellowish posteriorly 7
6. Legs reddish yellow or brown (Fla. to N. C. and La.) ..... **assidua**
   Legs black, or the tibiae alone reddish (Canada and U. S.; rare southward) ..... **latisetosa**
7. Anterior clasper broadened along the apical third of its length by its thin, explanate, internally curved outer margin (Coachella and Imperial Valleys, Calif.) ..... **coachellensis**
   Anterior clasper not thus broadened apically (Widespread in Southern two-thirds of U. S.) ..... **laakei**
8. Sternite 7 completely divided or constricted medianly; sternite 6 larger than 7 (figs. 16, 17, 20) 9
   Sternite 7 entire, not constricted, and larger than 6 (figs. 15, 18, 19) 12
9. Sternite 7 completely divided, so that sternites 6 and 8 are joined together; sternite 6 with a shallow groove preceding the emarginate posterior margin (fig. 16) ..... **derelicta**
   Sternite 7 separates 6 and 8; sternite 6 not grooved on its surface or emarginate posteriorly (figs. 17, 20) 10
10. Legs reddish yellow or brown ..... **assidua**
    Legs wholly black, or the tibiae alone sometimes brownish 11
11. Sternite 6 exposed, usually larger and broader than sternite 2, its hind margin angular; sternite 7 with concealed anterior lobes strongly produced, their inner margins parallel (fig. 20) ..... **coachellensis** and **laakei**

Sternite 6 usually smaller, more rounded, more likely to be concealed in great part by the fourth tergite; sternite 7 with concealed anterior lobes bluntly rounded (fig. 17) ..... **latisetosa**

12. Sternite 7 elongate, glabrous posteromedianly (fig. 19) ..... **errabunda**
Sternite 7 neither elongate nor glabrous (figs. 15, 18) 13

13. Sternite 7 subquadrangular, with lateral margins parallel and posterior margin emarginate (fig. 18) ..... **effrenata**
Sternite 7 transversely oval (fig. 15) ..... **anandra**

Chaetoravinia anandra new species
(FIG. 15)

Length 4.0–6.7 mm. A small species with darker genital segments and sternites 6 to 8 very different from the other U. S. species. Its affinities appear to lie with the Neotropical *C. almeidai* Lopes, which has similar but broader female sternites, and parafacials yellow.

Female. Head grey, nearly a third higher than long, with three rows of black postorbital bristles; front 0.33 of head width at vertex, 0.41 at lunule. Inner and outer vertical bristles developed; frontoorbitals 2 proclinate and 1 reclinate; frontal rows of 6 bristles, the rows not divergent anteriorly and slightly surpassing the middle of the second antennal segment. Antennae black, reddish at last joint, third segment 2.4 as long as the second; arista long plumose on basal half. Clypeus moderately dished; epistoma warped forward, slightly below vibrissae. Parafacials each with a row of fine black hairs. Cheeks 0.42 of eye height, dark haired. Palpi black.

Thorax grey with three dark stripes, the median stripe extending posteriorly to middle of scutellum. Chaetotaxy: acrostichals 3: 1; dorsocentrals 3: 4; intra-alars 1: 2; supra-alars 1: 3; humerals 3; posterior callus with 2; scutellum with 2 pairs marginals, 1 pair discal, no apical, sternopleurals 3; propleura bare; prosternum haired. Wings hyaline, costal spines vestigial, veins 1 and 3 setulose; epaulets brown; squamae white.

Abdomen grey, with changeable checkered pollinose pattern dorsally, uniformly pollinose ventrally; median marginal bristles on third tergite. Genital segments pollinose; first genital tergite dark, vaguely reddish on hind margin; genital sternites (fig. 15): sternites 7 to 8 reddish; sternites 6 to 8 transversely oval, the seventh largest. Legs black; middle femur with two anterior bristles.

Male: Unknown.

Holotype female, Kennesaw Mt., Cobb County, Georgia, June 18, 1952, CDC fly trap. Type number 62337, U. S. National Museum.

Paratype females are widely distributed in many collections. The locality data of 198 specimens are as follows: Alabama (24): 22 Montgomery, 2 without other data. Arkansas (6): Fayetteville, Benton, and Mississippi Counties. District of Columbia (1): Washington, D. C. Georgia (126): 114 Tifton (June to October, 1896, Hough collection at Chicago Natural History Museum); 4 Yonah Mt.; 2 Atlanta; 1 Augusta; 1 Manchester; 2 Putney; 1 Talbotton; 1 Villa Rica. Indiana (1): Winona Lake. Kansas (1): McPherson County. Maryland (1): Chevy Chase. Missouri (3): Kirkwood. North Carolina (4): Asheville; Croatan; Hertford County; Raleigh. New Jersey (4): 1 Atco; 1 New Brunswick (?); 2 Cape May. New York (3): Babylon, Long Island. Nebraska (2): Lincoln. Ohio (10): Columbus; Ironton; Lockbourne; Sandusky; Miami; Ottawa, and Summit Counties. Texas (1): Warren. Virginia (3): Boykins; Dixie Lodge; Luray Caverns. Ontario (1): Point Pelee.

In addition to the specimens listed above, the following have been identified in material which has been reared or taken by trap. All are considered to be of paratype value, but many have not been mounted or labeled.

Reared: 165 females, Georgia: 24 Savannah, 1948, reared from dog excrement by K. D. Quarterman; 122 Thomasville, May 14 to November 20, 1949–50, reared from various media, chiefly human and dog excrement, by T. W. Haines; 9 DeKalb County, progeny, reared on meat from gravid female collected October 6, 1949, by H. R. Dodge.

Trapped: 1473 females. Alabama (9): Montgomery, 1946–47, H. R. Dodge. Delaware (3): Wilmington, 1947, CDC fly traps. Florida (436): 432 Bradenton, Dec. 25 to March, 1950 to 1952, H. B. and H. R. Dodge; 4 Perry and Dunnelon, 1952, U. S. D. A. screw-worm status traps. Georgia (734): 12 Atlanta; 520 DeKalb County, March 28 to November 22, 1948 to 1952, H. R. Dodge, collector; 27 Dougherty, Tifton, and Worth Counties, O. K. Fletcher; 17 Gracewood, J. M. Seago; 21 Savannah (and Chatham County) H. R. Dodge and J. W. Kilpatrick; 67 Thomas County, T. W. Haines; 28 Kennesaw Mt., Blood Mt., and Rabun Bald, 1952, Dodge and Seago; 42 miscellaneous other localities. Kansas (4): Topeka, May 18 to July 27, 1948–50, CDC traps. Kentucky (5): Harlan and Cumberland County, 1951–52, CDC traps, E. V. Welch. Louisiana (4): 3 LaFayette, October, 1947, H. R. Dodge; (1), New Orleans, 1951, A. Miller. Michigan (49): Muskegon, June 15 to September 6, 1948 to 1950, CDC traps. New York (2): Troy, 1948 to 1950, CDC traps. Tennessee (37): 17 Nashville, 1947, H. R. Dodge; 20 Athens, 1952, W. E. Snow. West Virginia (183): Charleston, 1948 to 1951, April 26 to October 4, CDC traps. Wisconsin (7): 2 Stoughton, 1952; 5 Clintonville, 1951, H. R. Dodge.

Bionomics: This is evidently a common coprophagous species. The accumulated evidence of 1671 females, of which 165 were reared, without a single recognized male indicates strongly that this species is parthenogenetic. To the writer's knowledge this phenomenon has not been previously reported in this family of insects.

Distribution: Chaetoravinia anandra is evidently a widespread fly in the eastern United States ranging northward to the coniferous forest belt of the northern states and southern Canada, and westward to the Great Plains. Extensive trapping in Hidalgo County, Texas, and some western localities has not revealed its presence. It also has not been taken by trapping in Miami or the Florida Keys. However, in central Florida (Bradenton) it has been commonly trapped in the winter months and probably breeds all year. The failure to record this species from certain eastern states indicates a lack of data, especially fly trap records, from those localities (Illinois, Iowa, Mississippi, South Carolina, Pennsylvania).

Variation: No morphological variation has been noticed in the female genital segments. There is some variation in the extent of the reddish color of the usually nearly dark genital segments, the first tergite often being wholly dark and rarely mostly reddish. The Atco, N. J., specimen (Museum of Comparative Zoology) has the first genital tergite entirely reddish; the fly is also unusually large for the species, namely 6.7 mm. in length.

Chaetoravinia derelicta (Walker)
new combination
(Fig. 16)

Sarcophaga derelicta Walker, 1852, Insects Saundersiana, p. 322.
Helicobia quadrisetosa Coquillett, 1901, Ent. News 12: 17.
Ravinia quadrisetosa Parker, 1914, Proc. Boston Soc. Nat. Hist. 35: 60.
Sarcophaga quadrisetosa Aldrich, 1916, Sarcophaga and Allies, p. 296.
Chaetoravinia quadrisetosa Townsend, 1917, Proc. Biol. Soc. Washington 30: 193.
Sarcophaga stimulans Aldrich, 1930 (nec. Walker) Proc. U. S. Nat. Mus. 78(12): 17.

This common coprophagous species was long known by the name of *quadrisetosa* Coq. until Aldrich (1930) synonymized it with *stimulans* Walker. However, Dr. van Emden has re-examined the female type of *stimulans* and found it to resemble *latisetosa* Parker and *vagabunda*. This leaves *derelicta* Walker as the oldest valid name for *quadrisetosa*, which is the genotype of *Chaetoravinia*.

The writer had applied the name "*stimulans* Walker" to specimens of *latisetosa* from eastern North America before the similarity of *vagabunda* females from Mexico was recognized. The type locality of *stimulans* was given by Walker as "N. A." The name should be set aside until specific differences in female *latisetosa* and *vagabunda* can be recognized; it antedates both these names.

Chaetoravinia assidua (Walker), new combination
Chaetoravinia latisetosa (Parker)
Chaetoravinia laakei (Hall), new combination
Chaetoravinia coachellensis (Hall), new combination

These four species, with the Mexican *vagabunda* (Walker), are considered to be very closely related but distinct. The female genitalia occur in two types: figure 17 illustrates the *assidua*, *latisetosa*, and *vagabunda* type; figure 20 illustrates the *laakei* and *coachellensis* type. As far as known *coachellensis* and *vagabunda* are isolated geographically, but *latisetosa* and *laakei* intermingle throughout a large part of central United States and seem to retain their separate identities. In southern Georgia and northern Florida all of the first three species occur.

C. assidua was misidentified until Aldrich (1930) examined the types. The species which was mistaken for it is now known as *Oxysarcodexia ventricosa* (Wulp), or *Sarcophaga ventricosa* Wulp.

Chaetoravinia effrenata (Walker)
Chaetoravinia errabunda (Wulp)

For synonymy of these two species see Lopes (1946, p. 131). Hall (1928) described them as *Sarcophaga adamsi* and *S. reinhardii*, respectively.

Ravinia querula (Walker) new combination

Sarcophaga querula Walker, 1849, List Dip. Brit. Mus. 4: 821.
Sarcophaga avida Walker, 1849, List Dip. Brit. Mus. 4: 822.
Sarcophaga aspersa Walker, 1849, List Dip. Brit. Mus. 4: 825.
Sarcophaga rabida Walker, 1849, List Dip. Brit. Mus. 4: 823.
Ravinia communis Parker, 1914, Proc. Boston Soc. Nat. Hist. 35: 55.
Sarcophaga pallinervis (in part) Hall, 1928 (nec. Thomson), Ann. Ent. Soc. Amer. 21: 331.
Sarcophaga lherminieri (in part) Aldrich, 1930, Proc. U. S. Nat Mus. 78(12): 13.

Ravinia lherminieri (Robineau-Desvoidy)
complex, redefined

Myophora lherminieri Robineau-Desvoidy, 1830, Essai Myodaires, p. 339.
Sarcophaga anxia Walker, 1849, List Dip. Brit. Mus. 4: 818.
Sarcophaga rediviva Walker, 1849, List Dip. Brit. Mus. 4: 823.
Sarcophaga comes Walker, 1852, Ins. Saundersiana, p. 323.
Sarcophaga pallinervis Thomson, 1869, Eugenies Resa, p. 535.
Sarcophaga communis (in part) Aldrich, 1916, Sarcophaga and Allies, p. 253.
Sarcophaga pallinervis (in part) Hall, 1929, Ann. Ent. Soc. Amer. 21: 331.
Sarcophaga lherminieri (in part) Aldrich, 1930, Proc. U.S. Nat. Mus. 78(12): 13.
Ravinia lherminieri Lopes, 1946, Mem. Inst. O. Cruz 44(1): 136.

All of the names listed above under *querula* and *lherminieri*, plus *acerba* Walker, were cited as synonyms of *lherminieri* by Aldrich in 1930. To establish the above synonymy, the numerous species of Walker were re-examined by Dr. F. van Emden, *lherminieri* by E. Séguy, and *communis* by M. E. Smith. It was found that *acerba* Walker had only three posterior dorso-

central bristles, so it is removed from the *lherminieri* synonymy.

The differences between *querula* and *lherminieri*, most obvious in the female sternites, are set forth in the following key:

1. Scutellum with one pair of large subapical marginal bristles and a second pair, less than half as long, and sometimes vestigial; female sternite 7 subtriangular, its sides tapering posteriorly; male second genital segment less than 0.8 of length of head at antennal axis ..... **lherminieri** complex
   Scutellum with two or three pairs of subapical marginals, the second pair at least half as long as the hindmost pair and often nearly as long; female sternite 7 large, subrectangular, its sides slightly convex and not converging posteriorly; male second genital segment more than 0.8 the length of head ..... **querula**

Ravinia lherminieri, as newly restricted, is found to remain a complex on the basis of larval characters. Two larval forms are easily recognized from pupal exuviae pinned with reared flies. The first form is figured by Greene (1925, pl. 1, Fig. 3) from Texas, and also has been received by me from Hawaii. The second form, very similar to that figured by Greene (above) for *ochracea* Aldrich, has been seen from Black Forest, Colorado (reared by G. W. Macdougall).

The ratio of the length of the second genital segment divided by the length of the head in *lherminieri* varied in 10 specimens from 0.66 to 0.80 (average 0.72). In 10 specimens of *querula* the variation was 0.85 to 0.94 (average 0.89).

Both species are widely distributed in the United States and southern Canada, being absent only in Florida and the adjacent South Atlantic and Gulf coastal plains. *Lherminieri* has a slightly greater range in the Southeast, and also occurs in Mexico and Hawaii.

Ravinia acerba Walker, new combination

Sarcophaga acerba Walker, 1849, List Dip. Brit. Mus. 4: 824. Nova Scotia.
Ravinia peniculata Parker, 1914, Proc. Boston Soc. Nat. Hist. 35(1): 58 (new synonymy).
Sarcophaga lherminieri (in part) Aldrich, 1930, Proc. U. S. Nat. Mus. 78(12): 13, 15.

The writer believes *acerba* to be the oldest name for *peniculata* Parker. It is a widely distributed species in Canada and the northern United States, differing from *pusiola* by its larger size (7 to 8.5 mm. in Parker's material) and more glaucous body. The type of *acerba* has only three posterior dorsocentral bristles; this fact was obviously overlooked by Aldrich (1930) when he synonymized this species with *lherminieri*.

Ravinia pectinata (Aldrich), new combination

Sarcophaga pectinata Aldrich, 1916, *Sarcophaga* and Allies, p. 251.
Sarcophaga orbitalis Hall, 1928, Ann. Ent. Soc. Amer. 31: 337 (new synonymy).

This synonymy seems certain from a comparison of the genitalia of the holotypes by Mr. Sabrosky and the writer. Hall's species, *orbitalis*, was originally distinguished by the presence of proclinate orbital bristles in the male sex. This character is quite unusual, and where it occurs it is usually the basis of generic distinction. However, in this species the character is variable, as may be seen in the National Museum series of *pectinata*, and in a series of males taken by the writer at LaFayette, La. All variations have been seen, from no proclinate fronto-orbitals to two well developed pairs.

This species is rather uncommon, ranging in the eastern United States westward to Paonia, Colorado (not Colombia, as stated in the original description), which is the type locality of *orbitalis*.

Sarcophaga wrangeliensis Parker

Sarcophaga wrangeliensis Parker, 1920, Bul. Brooklyn Ent. Soc. 15: 107.
Sarcophaga cosmeta Reinhard, 1947, J. Kans. Ent. Soc. 20: 112 (new synonymy).

This synonymy was verified by Prof. Reinhard. The species was described from Vancouver, B. C. and Fort Wrangel, Alaska, and was recorded from Wash. and Ore. by Reinhard. The writer has seen specimens from California: Carmel, Oakland, and Mill Valley, Marin County, in the California Academy of Sciences. The body is very shining, black, in both sexes and the females have several strong parafacial bristles, much stronger than in the males. Several males have many supernumerary marginal scutellar bristles.

Mantidophaga stagmomantidis Townsend

Mantidophaga stagmomantidis Townsend, 1919, Ins. Ins. Mens. 6: 160.
Sarcophaga austinana Reinhard, 1942, Proc. Ent. Soc. Washington 44:17 (new synonymy.)

This species was described from three females which were reared from *Stagmomantis* at Washington, D. C. Paratypes of *austinana* are before me and the females are indistinguishable from *stagmomantidis*. This species is very closely related to *Sarcophaga flavipes* Aldrich, and possibly represents only a variety of that species.

Sarcofahrtia montanensis Parker

Sarcofahrtia montanensis Parker, 1919, Ent. News 30: 201, 203, figs. 1, 3.
Sarcofahrtia femoralis Reinhard, 1937, Bull. Brooklyn Ent. Soc. 32: 63 (new synonymy).

This synonymy was established by the writer by an examination of topotypical material of both species and confirmed by comparison with the types by Sabrosky and Reinhard. The protuberance at the base of the femur is present in both *montanensis* and *madisoni* Parker, though overlooked by Parker in the descriptions and figures.

Acridiophaga amblycoryphae (Coquillet), new combination

Sarcophaga amblycoryphae Coquillett, 1904, Proc. Ent. Soc. Washington 6: 187.
Amblycoryphenes amblycoryphae Townsend, 1918, Ins. Ins. Mens. 5: 161.
Sarcophaga lorena Roback, 1952, J. Washington Acad. Sci. 42: 45 (new synonymy).

The genus *Amblycoryphenes* was maintained by Townsend as distinct and removed to the tribe Myorhinini in his "Manual of Myiology," but the genitalia of both sexes shows close affinities with *Acridiophaga* (genotype, *aculeata* Aldrich). The writer has seen four females from N. Saugus, Mass., Jamesbury, N. J., Great Falls, Va., and Lakeside, O., one male from Washington, D. C., and four males from Tray Mt., and Kennesaw Mt., Georgia. The Tray Mt. specimen has legs partly reddish, whereas the three Kennesaw Mt. males have legs entirely red as in *ignipes* Reinhard. The Georgia material agrees well with the figure of *lorena* (Long Island, N. Y.). The writer believes that *lorena* is the male of *amblycoryphae* and that *ignipes* may be only subspecifically different. A fifth male *amblycoryphae* in the U. S. National Museum is from Washington, D. C., August, 1923, J. M. Aldrich.

Sarcophaga aratrix Pandellé

This Palaearctic species is recorded from the Nearactic region for the first time. One male in the U. S. National Museum is from Churchill, Manitoba, Aug. 5–6, 1937 (D. G. Denning, collector), and agrees very well with European specimens. The species is called *Parasarcophaga* (*Rosellea*) *aratrix* (Pand.) by Rohdendorf (1937, p. 243). For references to this species see Séguy (1941, p. 75).

ACKNOWLEDGEMENTS

The writer is indebted to the following persons for assistance in this study: Mr. Curtis W. Sabrosky, Dr. Fritz I. van Emden, Prof. H. J. Reinhard, Dr. Marion E. Smith, Dr. Maurice T. James, M. E. Séguy, and Dr. Harry D. Pratt.

SUMMARY

Two new genera and four new species of North American Sarcophagidae are described. Keys are given to the United States species of *Chaetoravinia*, and some new synonymy is presented, especially in *Chaetoravinia* and *Ravinia*. One palaearctic species is recorded from Manitoba.

One new species, *Chaetoravinia anandra*, appears to be parthenogenetic. This phenomenon apparently has not been previously reported in this family of insects.

REFERENCES CITED

Greene, Charles T. 1925. The puparia and larvae of sarcophagid flies. Proc. U.S. Nat. Mus. 66 (29): 1–26.
Hall, D. G. 1928. *Sarcophaga pallinervis* and related species in the Americas. Ann. Ent. Soc. Amer. 21: 331–52.
Lopes, H. de Souza. 1946. Sarcophagidae do México, capturados pelo professor A. Dampf. Mem. Inst. Osw. Cruz, 44: 119–46.
Rohdendorf, B. B. 1937. Sarcophagidae, *in* Faune de l'U.R.S.S., Ins. Dipt. 19: 1–501.
Séguy, E. 1941. Études sur les mouches parasites. II. Calliphorides. Encycl. Ent (A) 21: 1–436.
Townsend, C. H. T. 1935. Manual of myiology. Part 2. 289 pp.

BOOK NOTICES

THE DISTRIBUTION AND ABUNDANCE OF ANIMALS.
H. G. Andrewartha, Waite Agricultural Research Institute, University of Adelaide, and L. C. Birch, Department of Zoology, University of Sydney, Australia. Cloth xv + 782 pages., illus. Chicago, University of Chicago Press, 1954. Price $15.00.

The authors of this volume were co-workers with the late James Davidson at the Waite Institute, and the book naturally reflects this experience. Their work has been largely in economic entomology, and the examples cited throughout the work are quite largely entomological.

Ecology has often been divided into autecology, or the ecology of the individual and synecology or the study of communities. The subject matter of this book occupies an intermediate position, being the study of populations of one species in relation to its environment. A considerable part of the subject matter has been discussed in other books, but it is here brought together and made more useful.

In the introduction, the authors discuss the scope of ecology and the components of the environment, which they list as weather, food, other animals and organisms, and a place to live in. The next part of the book considers the innate capacity for increase in numbers, diapause, and dispersal. The third part discusses the environment, with chapters on temperatures, moisture, light, other animals of the same kind, other animals and organisms of different kinds, natural populations, food, and a place to live. The fourth part considers the numbers of animals in natural populations and presents a general theory to account for the changes in numbers in natural populations. In the final section the genetic plasticity of species and the relation of ecology to the origin of species are discussed. The book is well indexed, with a bibliography of about 40 pages covering most of the pertinent literature. A useful feature of the bibliography is the inclusion at the end of each citation of page references to places where the particular paper is discussed, thus combining the bibliography with an author index.

Throughout the book the authors show great independence of thought, and have little regard for principle

that have been taken for granted, but never adequately examined and tested. They decide, after considerable discussion, that the often-made distinction between "density-independent" and "density-dependent" factors is largely artificial, as it is almost impossible to cite a factor whose effects are not related to the density of the organism under discussion.

In the second section they devote considerable space to the definition and calculation of a statistic they call the "innate capacity for increase". This is not a constant for the species like the "biotic potential" of Chapman, but represents the maximum rate of increase possible under a particular set of external conditions. This statistic is used frequently in the later discussions.

The chapter on relations with other animals of the same kind contains a discussion of the logistic growth curve as applied to animal populations. The writers have difficulty in finding populations to which it can properly be applied. They conclude that populations of animals with a simple life history, like protozoa, conform generally to the logistic curve, but that more complex situations require a modification of the curve. In many cases with natural outdoor populations, growth along what might eventually prove to be a logistic curve is interrupted by unfavorable weather or food conditions. They feel that parasites and predators are very largely secondary in their roles of population control.

The various mathematical models for the host-predator relation are carefully examined and found inadequate to explain many natural occurrences. The authors feel, as does the reviewer, that population growth is initiated during favorable weather conditions, and this growth may be suddenly terminated by the occurrence of unfavorable conditions. The duration and severity of any particular insect outbreak is related to the length and suitability for multiplication of the favorable period, while the frequency of outbreaks is related to the frequency with which favorable periods occur.

The authors present a general theory of the numbers in natural populations, considering food, shelter, other animals and weather conditions. The theory is presented in very general terms without any mathematical discussion, but with sufficient theoretical examples to outline their thesis clearly. Animal numbers may be restricted by any of the above factors, or by any combination of those factors. The course of events in any particular case can be estimated by following the effects of the single factors and combining them. In a short discussion that could have been expanded profitably, they fit the use of insecticides into their population theory.

The book contains a very large amount of material, well organized, and presented so as to give the working economic zoologist much food for thought. It covers one of the most useful and practical phases of ecology.

WILLIAM C. COOK

THE EVOLUTION OF AN INSECT SOCIETY, by DEREK WRAGGE MORLEY. Charles Scribner's Sons, New York. vi + 215, 31 figs. 1955. $3.95.

This volume is an account of the intricate society of the common Wood Ant, *Formica rufa*, as it occurs in Surrey, England. The author made detailed observations over a period of 15 years on a group of nests, some of which had been in existence for a much longer time. One colony (Mother Nest) is reported to have been known by local inhabitants for as long as 39 or 40 years, apparently remaining in the same spot. The nests are all part of one, large intermingling unit which the author chooses to call a commune, and are connected by trails over which members of different colonies may pass and communicate. The organization of a colony is described, including the various castes and their behavior, and each is treated in detail. Estimates of numbers of individuals are provided also. A description of the nest, its size, shape, extent, position, and details of construction are carefully given. Information on the daily activities of the ants in this society provides a graphic picture of life in one of these nests.

Mr. Morley devotes a large portion of the book to a consideration of the evolution of ants as a group of insects, and attempts to show how the highly social Wood Ants have developed from the early, primitive types of ponerine ants. Comparisons are made of the anatomy, physiology, behavior, and development of these insects, and the relative points in time when advancements achieved in the evolution of ants make their appearance as specialized traits in the growth of a Wood Ant nest. The origin of the queen caste, its effect on worker behavior and general economy of the colony, improvements of the nest structure, the development and significance of the "social stomach" or crop, the change in ant food, the increase in manifold duties of a worker ant, necessary defense of the nest, acquisition of distinctive odor badges and recognition among individuals, nests, and communes, and the division of labor in a society, are all discussed at length. The sequence of these advances, the times of origin, and the conditioning of one advance by others that preceded it are woven into the general ontogeny of a Wood Ant commune, which the author regards as the highest expression of social development in the Formicidae. The work is concluded with an historical account of the beginnings, changes, successes, and demises of the nests which were personally observed in one particular commune, and the final chapter consists of a sort of resumé of the preceding discussions and explanations.

This book is a good example of what is possible to achieve by the close application of one man's attention to the biological details of one species of ant in a circumscribed area (several hundred square yards of heathland), over an extended period of time. There is no doubt Mr. Morley has a most intimate acquaintance with these particular ants and this particular species. It is fully appreciated that his book is directed toward the lay reader, for it is written in an entertaining style, unencumbered for the most part by references to literature or documentation of statements. This may be satisfying to the uncritical person seeking to broaden his horizons, but to colleagues in myrmecology it is a serious fault. There are many questions left unanswered, many statements that need bolstering by reference to other published information or new data discovered by the author, some statements that seem to stem from misinterpretations, and others that look like outright false statements which will astonish ant students and biologists in general. It is obviously impossible to give all the facts on which these points are based, but anyone who reads the book may verify them for himself. Some of the most important criticisms which may be directed toward it follow herewith.

There is no glossary of terms. Technical words are kept to a minimum, no doubt to ease the reader's learning pains. Nevertheless, scientific terms are coined to give exact meaning and convey definite ideas which ordinary English words often fail to do, and a too rigorous deviation from special terminology only leads to misunderstanding and confusion on the part of the reader. Mr. Morley discusses at length the phenomenon of mutual exchange of food droplets and other substances, yet never once mentions the term "trophallaxis" or the clear-cut explanations of social behavior that Wheeler gave when he proposed the word. According to Morley, the crux of the understanding of the behavior of the Wood Ants lies in the activities of the "excitement centre ants", and one gains the impressions he could not accept a theory of trophallaxis. The excitement center ants doubtless play a part, but can hardly be a complete explanation in themselves.

No bibliography whatever is provided that would lead the interested reader to important works. The publications of a few persons are acknowledged in the preface, with an allusion to "many others", but there is almost no indication of the printed evidence supporting the innumerable assertions to be found in the text. The

author speaks with complete assurance of what goes on inside a nest among the workers or among the workere and queens, or when a particular young queen invades a host nest to enslave its inmates and establish her own city. The narrative style leads one to believe that he knows exactly what a given individual did, when, and how many times. We know from past researches what can happen under laboratory conditions in observation nests, but to imply precisely what took place in the dark recesses of a nest in the field is very misleading to the casual reader. It is difficult to ascertain what knowledge is his own and what is borrowed from others. After many years of concentrated effort gathering data, he gives practically none of them, either in raw form or digested and compiled into tables. If the essential facts, on which so much detailed discussion is based, are in existence, then such evidence presented in unequivocal form would be much appreciated.

Much of what Mr. Morley has written is stimulating and pleasant to read, but other passages are so long and involved that they destroy the meaning of the sentence. The discourse lends itself to flights of fancy and anthropomorphism that are well-nigh intolerable. An example of his anthropomorphism is to be found in the middle paragraph of page 21, and again on page 24. It is news indeed to find that ants are subject to temptation!

Table I (p. 30) gives populations of various nests used in this study, but nowhere in the text could I find an adequate explanation of methods employed to obtain these figures.

The differences among ant castes are discussed (p. 63), and the conclusion is reached that they are determined by fundamental [hereditary] differences in the egg. But the great bulk of evidence, so far as I am aware, indicates otherwise and favors a trophogenic origin of castes, though admittedly no one knows just how the determining factors operate.

The food budget of different species of ants is described on pages 68 to 70 and a table is provided for comparisons, but little explanation is given for the methods of arriving at the figures. The reader is left with a foggy notion of what the author has in mind.

The statement is made (p. 78) that *Formica* contains no species that are physically or physiologically specialized and the species are not isolated by such means. Then within a few lines it is pointed out that the *microgyna* group is distinguished by its small queens. Such contradictions of his own making are fairly numerous throughout the book.

Bad compilation on the part of the printer (presumably the author read proof) is evidenced by duplication of most of Chapter Four, "The Economy is Affected", pages 65 to 80.

Plate 16b (facing p. 96) shows a worker and soldier of *Messor barbarus*, and the labels on these two castes are reversed. This resulted probably from the fact that the figure is upside down.

In numerous places (eg. p. 107), Mr. Morley refers to the Wood Ants as the social ants, implying that *Amblyopone* and other primitive ponerines are not social. I cannot agree with this interpretation, for while the Formicines are among the most highly social of all insects and more so than the ponerines, all species of ants are social, even the latter, for they possess at least the basic attributes of sociality. There are no solitary ants as there are bees and wasps.

His general discussion of the antiquity of ants (Ch. 2) appears to be, on the whole, in good order, showing as it does that the fossil record of ants is, geologically, comparatively recent, extending to the Eocene. Then on page 137, he claims that the earliest ponerines lived almost 200,000,000 years ago! This would place them as far back as the beginning of the Mesozoic when the Hymenoptera as an Order were possibly being differentiated. Ants are far from being the most primitive hymenopterans, and though they probably evolved long before the Eocene (the Tertiary fossils are of advanced types), they could hardly be as ancient as Mr. Morley confidently believes.

Pages 147 to 150 contain an unfortunate attempt to explain the behavior and integration of an ant colony by analogy with the operations of the nervous system of adult vertebrates. Mr. Morley makes the astounding revelation that nerve cells, like ants, can move about. They shift from place to place in the nerve tract, or send out neurites to localities where connections are needed, later withdrawing them when the traffic in nervous messages diminishes, and they are said even to leave the nerve by penetrating the sheath to wander out into the adjacent tissues. He seems to have confused certain findings concerning the activity of nerve cells in a developing embryo, and their nature in the adult, but in any event the assertions cannot be regarded as accurate. Rather than comparing the moving and shifting individual ants to the cells of the nervous system, or vice versa, as a means of showing the coördination of the body and the colony, he might with more reasonable expectation of success have compared them to the humoral substances of the body which can and do circulate throughout the organism.

Mr. Morley speaks at length concerning the excitement center ants (referred to earlier), and also that these exist in primary and secondary degrees. It would be reassuring if he had taken the trouble to tell us how he discovered the facts about such ants, and their relative individual ages. Did he perform careful marking experiments and trace the behavior of each over long periods of time? He gives no evidence of it. In Plate 26 (facing p. 176) he presents a picture to illustrate the differences in working ability of various individuals and how they influence each other, but one can only guess at the nature of the work and the meaning of the little piles of sticks beside each ant portrayed. The text presents an inadequate discussion of the situation (p. 152).

On page 177 the author maintains that by removing an excitement center ant from a colony, its influence through the contacts of overlapping generations on future individuals will be lost— "the psychoplasm of future generations suffers." And then he says, "For one thing is obvious; somewhere, somehow, at some stage of time, behavior that has been acquired becomes more firmly fixed." I take this to mean a genetic fixation of acquired characters, and if so he is resorting to the long outmoded doctrines of Lamarck. In the ensuing sentences he speaks of "pysches" and "essences" with a confusing and unconvincing Lamarckian flavor to his exposition.

Page 178 presents the claim that nothing remains, not even an odor trail over the winter, to guide the ants back to a food source previously used, when spring again returns. The knowledge to forage in a certain direction is retained all winter in the *memory* of a few excitement center ants. If they die, the knowledge is lost to the colony. Recognition of direction, as pure compass direction unaided by various cues, must be a most remarkable possession in these insects; it has not yet been demonstrated beyond question for birds or for man. Mr. Morley does not explain how he discovered this ability in ants or present the evidence that rules out other possible factors in orientation.

Finally, on page 201 he postulates again the transmission of social learning from one generation to another through the "lowly psyche of the worker ants." He ignores the very fundamental fact pointed out nearly a hundred years ago by Darwin that ants provide some of the best evidence against Lamarckism in that acquisitions of the normally sterile worker caste cannot be transmitted to the reproductives (fertile males and queens) of the succeeding generation. Ants can learn, as shown by well-known experiments, but the transmission of their experiences from one adult to another has not been proved. And even if the knowledge were passed from one nest to the next by the workers within a commune, this would not explain the transmission of complex behavior responses from a parent commune to a new and distant one founded by a single, fertilized female or queen when she invades and parasitizes a nest of *Formica fusca*.

ROBERT E. GREGG.

THE WORLD OF BEES, by GILBERT NIXON. Philosophical Library, N. Y. 214 pp., 16 figs., 1 color plate. 1955. $4.75.

Gilbert Nixon has a message. Divorce yourself from the pressures of modern life, take your insect net and paraphernalia bag in hand, and enter the secret world of bees. This may seem a naive message but Mr. Nixon is very persuasive. His is the outlook of the old-time naturalist—pure delight in the infinite wonder and variety of nature's ways.

The book is highly popular and devotes many pages to elementary biological and entomological material. However, the author has organized his subject in a logical fashion and his descriptions and conclusions are usually clearly stated. He could have condensed his information about bees in a few short articles, but in the process his engaging prose, and probably most of his public, would have been lost.

The first few chapters define and describe bees. We are introduced to their physical adaptations and nest-building habits. A concise discussion of the social life of honey bees is followed by a backward look at bumble bees and the subsocial forms. The harrowing tale of cuckoo bees, cuckoo wasps, and velvet ants comes next. Finally, we are presented with a series of essays on bees as aggressors, lovers, thinkers, perceptors, pollinators, and honey producers. The book closes with a rather uninformative chapter on how to study bees.

The author has used an anthropomorphic style in places but points out that he does this to avoid being tediously pedantic. He offsets his flights of poetic fancy by reminding us on numerous occasions not to impute human motives to insect behavior.

Mistakes are few. I do not agree with Mr. Nixon that *Halictus* cannot inflict a sting on humans whereas some of the larger *Andrena* can. The reverse is true. Mr. Nixon writes that the larvae of cuckoo bees have no special equipment for destroying their host eggs or larvae. Actually, the first stage larvae of most cuckoo bees are provided with a pair of sickle-shaped mandibles well adapted for their lethal purpose.

In the bumble bee section, the claim is made that the the workers store more honey in special pots than in old cocoons. This is counter to my observations of several Utah species.

These are all minor details. A more serious error, if it is an error, concerns the biology of a subsocial halictid, *Halictus malachurus*. Mr. Nixon writes that the overwintered female dies as soon as her brood is provided for and her offspring (all females) remain virgin but produce offspring of both sexes. Among Hymenoptera virgin females do not ordinarily produce diploid offspring. It seems much more likely that the overwintered female lives long enough to lay fertilized eggs on some of the pollen balls fashioned by her daughters.

Excellent full-page illustrations of representative bees drawn by Arthur Smith give the book attractiveness and serve to orient the uninitiate. A few more illustrations of the bees at work, or of the results of their work would have been helpful.

I would not hesitate to recommend the book to hobbyist beekeepers, nature lovers, and to high school or college freshman biology students. Entomologists and advanced students of biology will feel the desire to skip passages and paragraphs dealing with "old stuff." Considering the smallness of the book and the quality of binding and paper, $4.75 seems to be an exorbitant price.

G. E. BOHART.

Fishing with Natural Insects

by ALVAH PETERSON,
Professor of Entomology,
The Ohio State University,
Columbus 10, Ohio

Chiefly a Handbook of Insects for Bait Use
Non-technical and Extensively Illustrated

SOME TOPICS DISCUSSED

Some essential facts about insects.
Life and habits of more than sixty kinds of bait insects with photographs.
Collecting, trapping, rearing, maintaining, and preserving bait insects with illustrations.
A bait calendar.
Insects for winter and ice fishing.
Some lures that resemble insects.
Location, natural food and bait insects for twenty-five common pan and game fishes.

Off Press on or About April 15, 1956

Cloth-bound, 6 x 9, letter press on enameled paper with 64 plates of figures.

HOW TO PURCHASE

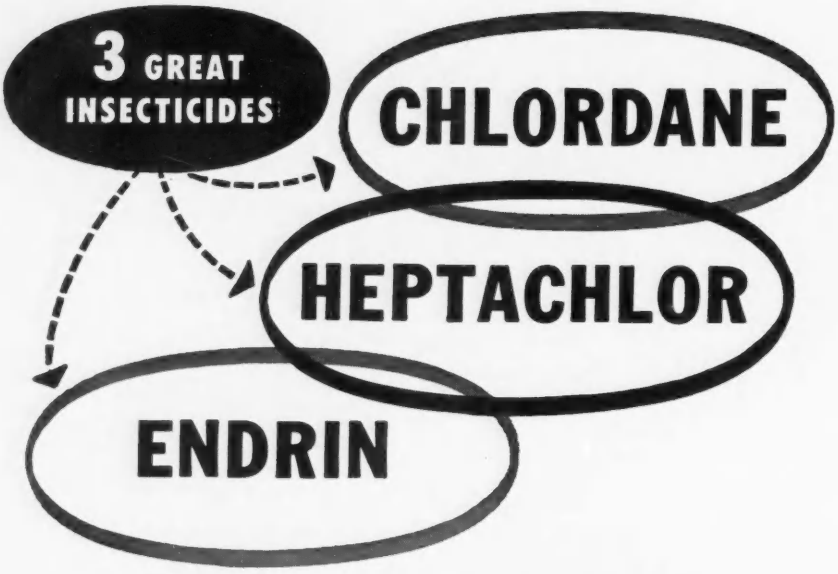
Distribution is handled by the Author.

Place orders with the Author or a Book Dealer. If you live in the State of Ohio all taxable orders must come through a book dealer.

If money comes with order postage is prepaid in U.S.A. Book dealers and Public Libraries receive a discount. Price $6.00

"An excellent book for any fisherman, naturalist or Public library."

THE SPAHR & GLENN CO.
FIFTY EAST BROAD STREET, COLUMBUS 15, OHIO



CONTROL THESE INSECTS

CHLORDANE: Ants, Armyworms, Blister Beetles, Boxelder Bug, Brown Dog Tick, Cabbage Maggot, Carpet Beetles, Cattle Lice, Chiggers, Cockroaches, Crickets, Cutworms, Darkling Beetles, Dog Mange, Earwigs, Fleas, Flies, Grasshoppers, Household Spiders, Japanese Beetle Larvae, Lawn Moths, Lygus Bugs, Mole Crickets, Mosquitoes, Onion Maggot, Onion Thrips, Plum Curculio, Sarcoptic Mange, Seed Corn Maggot, Sheep Ked, Silverfish, Sod Webworms, Southern Corn Rootworm, Strawberry Crown Borer, Strawberry Root Weevils, Sweet Clover Weevil, Tarnished Plant Bug, Termites, Ticks, Wasps, White Grubs, Wireworms...and many others.

HEPTACHLOR: Alfalfa Snout Beetle, Alfalfa Weevil, Ants, Argentine Ant, Armyworms, Asiatic Garden Beetle Larvae, Black Vine Weevil, Root Maggots, Clover Root Borer, Colorado Potato Beetle, Corn Rootworms, Cotton Boll Weevil, Cotton Fleahopper, Cotton Thrips, Crickets, Cutworms, Egyptian Alfalfa Weevil, European Chafer, Eye Gnats, False Wireworms, Flea Beetles, Garden Webworm, Grasshoppers, Japanese Beetle, Leaf Miners, Lygus Bugs, Mormon Cricket, Mosquitoes, Narcissus Bulb Fly, Onion Maggot, Onion Thrips, Rapid Plant Bug, Rice Leaf Miner, Salt Marsh Sand Fly, Seed Corn Maggot, Spittlebug, Strawberry Root Weevils, Strawberry Rootworms, Sugar Beet Root Maggot, Sweet Clover Weevil, Tarnished Plant Bug, Tuber Flea Beetle, Western Harvester Ant, White Fringed Beetles, White Grubs (June Beetles), Wireworms ...and many others.

ENDRIN: Budworms, Cabbage Worms, Cotton Boll Weevil, Cotton Bollworm, Cotton Fleahopper, Fall Armyworm, Grasshoppers, Hornworms, Leafworms, Rapid Plant Bug, Spiny Bollworm, Sugar Beet Webworm, Tarnished Plant Bug, Thrips.

WRITE FOR FULL PARTICULARS

VELSICOL CHEMICAL CORPORATION

VELSICOL

General Offices and Laboratories
330 East Grand Avenue, Chicago 11, Illinois

Foreign Division
350 Fifth Avenue, New York 1, N. Y.

REPRESENTATIVES IN PRINCIPAL CITIES

SUSTAINING ASSOCIATES

ENTOMOLOGICAL SOCIETY OF AMERICA

The firms and institutions listed here are proudly acknowledged as Sustaining Associates of this Society. We commend these Associates to the attention of all our members. The effective years shown are as of March 10, 1956.

Acme Fertilizer Co.
Box 330
Wilmington, N. C. 1955

Agricultural Chemicals, Inc.
Llano, Texas. 1955

Agricultural Specialties
10219 Denton Drive
Dallas, Texas. 1955

American Cyanamid Co.
30 Rockefeller Plaza
New York 20, N. Y. 1955

Atlas Powder Co.
Chemicals Division
Wilmington 99, Del. 1955

Birds Eye Laboratories
162 South Main St.
Albion, N. Y. 1955–1956

California Spray-Chemical Corp.
Lucas and Ortho Way
Richmond, Calif. 1956

Chemagro Corp.
101 Park Ave.
New York 17, N. Y. 1955–1956

Colloidal Products Corp.
2598 Taylor St.
San Francisco 11, Calif. 1956

The Dow Chemical Co.
Agricultural Chem. Div.
American Legion Bldg.
Midland, Mich. 1956–1957

E. I. duPont de Nemours Co., Inc.
Agricultural Service & Deveopment
Grasselli Chemicals Dept.
Wilmington 98, Del. 1955

Eastern States Farmers Exchange, Inc.
26 Central Street
West Springfield, Mass. 1955

Fairfield Chemical Div.
Food Machinery & Chem.Corp.
420 Lexington Ave.
New York 17, N. Y. 1955

Farmers Cooperative Exchange, Inc.
Statesville Wholesale Service
Statesville, N. C. 1955

G. L. F. Soil Building Service
Div of Coop.G.L.F.Exchange,Inc.
Ithaca, N. Y. 1955–1956

Geigy Agricultural Chemicals
Div. of Geigy Chemical Corp.
62 West 2nd Street
Bayonne, N. J. 1956

General Chemicals Division
Allied Chemical & Dye Corp.
40 Rector St.
New York 6, N. Y. 1955

Gulf Oil Corp.-Gulf Refining Co.
Gulf Bldg.
Pittsburgh 30, Pa. 1955–1956

Hays-Sammons Co.
Mission, Texas. 1955

H. J. Heinz, Co.
Medina, N. Y. 1955–1956

Hercules Powder Co.
Agricultural Chemicals Div.
Naval Stores Dept.
Wilmington 99, Del. 1955–1956

Jackson & Perkins Co.
Newark, N. Y. 1955–1956

Maxwell Insecticide Co.
Cary, N. C. 1955

Merck and Company, Inc.
Chemical Div.
Rahway, N. J. 1956

Minerals & Chem. Corp. of America
210 West Washington Square
Philadelphia 5, Pa. 1955

Monsanto Chemical Co.
800 N. 12th Blvd.
St. Louis 1, Mo. 1956

Niagara Chemical Div.
Food Machinery & Chem. Corp.
100 Niagara St.
Middleport, N. Y. 1955–1956

W. R. Peele Co.
Clayton, N. C. 1955

S. B. Penick & Co.
50 Church St.
New York 8, N. Y. 1955–1956

Pennsylvania Farm Bureau Cooperative Assoc.
3609 Derry St.
Harrisburg, Pa. 1955–1956

Pittsburgh Coke & Chem. Co.
Pittsburgh, Pa. 1955

Port Fertilizer & Chem. Co.
P. O. Drawer W
Los Fresnos, Texas. 1955–1956

R. J. Reynolds Tobacco Co.
Winston-Salem, N. C. 1956

Rohm & Haas Co.
222 W. Washington Square
Philadelphia 5, pa. 1955–1956

Shell Chemical Corp.
Agricultural Chemicals Div.
460 Park Ave.
New York 22, N. Y. 1955

Southern Agricultural Insecticides, Inc.
Box 324
Palmetto, Fla. 1956

Standard Oil Co.
910 So. Michigan Ave.
Chicago 80, Ill. 1955

Stauffer Chemical Co.
380 Madison Ave.
New York 17, N. Y. 1955–1956

Superior Fertilizer & Chem. Co.
P. O. Box 1021
Tampa 1, Fla. 1956

Thompson-Hayward Chem. Co.
2915 Southwest Blvd.
Kansas City 8, Mo. 1956

The Triangle Co.
P. O. Box 1289
Salinas, Calif. 1956

Union Carbide & Carbon Corp.
32 East 42nd St.
New York 17, N. Y. 1955

United Fruit Co.
Research Dept.
80 Federal St.
Boston 10, Mass. 1955–1956

Velsicol Chemical Corp.
330 East Grand Ave.
Chicago 11, Ill. 1955–1956

Willson Products, Inc.
Reading, Pa. 1956

Woolfolk Chem. Works, Ltd.
P. O. Box 922
Fort Valley, Ga. 1955

TABLE OF CONTENTS

PAGE

LUDWIG, DANIEL., AND MARY C. BARSA—Variations in the Activity of the Succinoxidase System During the Development of the Mealworm, Tenebrio molitor Linnaeus (Coleoptera, Tenebrionidae) 103

BELKIN, JOHN N., AND WILLIAM A. MCDONALD—A Population of Uranotaenia Anhydor from Death Valley, with Descriptions of all Stages and Discussion of the Complex (Diptera, Culicidae) 105

GLANCE, GRACE—Slide Mounting of Collembolá 132

DILLON, LAWRENCE S.—The Nearctic Components of the Tribe Acanthocinini (Coleoptera: Cerambycidae) Part I 134

SRIVASTAVA, P. D.—Studies on the Copulatory and Egg-Laying Habits of Hieroglyphus nigrorepletus Bol. (Orthoptera, Acrididae) 167

TUTTLE, DONALD M.—Notes on the Life History of Seven Species of Anthonomus Occurring in Illinois (Curculionidae, Coleoptera) 170

EVANS, HOWARD E.—The Subgenus Pompilinus in Mexico (Hymenoptera, Pompilidae) 173

DORSEY, C. K., AND H. L. CARSON—Selective Responses of Wild Drosophilidae to Natural and Artificial Attrahents 177

DODGE, HAROLD R.—New North American Sarcophagidae, with Some New Synonymy (Diptera) 182

Book Notices 190